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ELECTRICAL REVIEW

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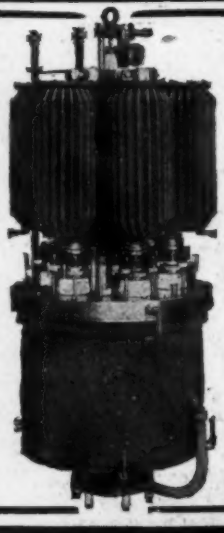

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THE COAL STRIKE.

UP to the last moment everyone hoped, and most believed, that the strike would not take place; however, in view of the heavy vote against the "datum line" proposal, the miners' leaders decided on Friday last that work in the mines must cease, and we are once more in the throes of a national struggle. We fear the leaders sadly misinterpreted the meaning of the vote, which was cast against the proposal before the men, but not for a strike; reports received at the beginning of the week indicated clearly that many of the men, though they had loyally obeyed the instructions of their leaders, did so reluctantly, and were astonished at the course which events had taken.

How long the strike will last, no one can foresee; but that, in any case, its effects will be disastrous to industry is, unfortunately, a certainty. Coal is the key of almost all our manufacturing industries, and even the threat of a coal strike had paralysed trade; according to Sir Allan Smith, contracts amounting to the value of £15,000,000 were cancelled in one branch of industry alone before the decision to strike was announced. We hear, on all sides, of works closing and employés being discharged, of blast furnaces being blown out, and textile mills being shut down. Prices generally had shown a tendency to fall, but that tendency will now be arrested and reversed. The American exchange has already begun to fall still lower, and the cost of imported food and raw materials will increase, while the cessation of export of coal will react upon our financial position, besides throwing idle vast quantities of labour and capital. Thus, thanks to the obstinacy of a well-paid industry, which refused to refer its claims to arbitration, the whole country, including the members engaged in that industry, will be further impoverished.

Engineering employers, as a whole, intend to carry on as long as their stocks of coal permit; some will be able to keep the wheels turning for a month to come, and in the national interest it is desirable that they should adopt this course. In many cases, however, there is little coal in hand, and some shops stopped as early as last week-end.

Electricity supply undertakings in general have a fair amount of coal in store, and can maintain the supply for a month to come, but at some important centres curtailment of tramway services and power supply is foreshadowed almost immediately. We give elsewhere particulars regarding the situation. Unfortunately, power alone will not serve to keep works going; as the supply of raw materials, particularly iron and steel, dries up, engineering works will have to close, and within a month enormous numbers of workers will be unemployed. Something can be done by economy in the use of electricity and gas for lighting and heating, but, after all, these are minor matters, and if the whole were shut down, the situation would not be appreciably relieved. A far greater field for economy is

found in the use of coal for domestic purposes, and we trust that this class of consumption will be restricted to the utmost.

Whether the railwaymen and transport workers will cease work in support of the miners is uncertain, but at present the probabilities are against their doing so. It is more likely that they will seize an early opportunity of offering their services as mediators. Already the miners are much better paid than the railwaymen, and as they did not strike in support of the latter last year, they can hardly expect to receive more effective support than they gave to their allies.

An admirable debate on the subject of the strike took place in the House of Commons on the first day of the session; an atmosphere of peace and conciliation prevailed, and the attitude of the Government invited suggestions that might lead to an early settlement. The only concrete proposal, however, came from the miners' side, in the form of a request that the 2s. per shift should be given, and the increase in output hoped for—which was only another way of calling upon the Government to surrender. Naturally and rightly the Prime Minister refused to yield without guarantees that the output would be increased; once given, the advance in wages could not be recalled. However, though the debate was not immediately fruitful, the moderation and sincerity of the speakers on both sides encourage us to hope that negotiations will be resumed, and a way will be found out of the present *impasse* in the near future.

London's Electricity Supply.

The inquiry by the Electricity Commissioners into the application of the County of London Electric Supply Co. for permission to build a generating station at Barking, of which the report is concluded in this issue, serves as a reminder of how little progress has been made in solving the London electricity supply problem since 1905. It was in that year that Mr. Merz promoted his first electric power supply scheme for London, and, for all practical purposes, the chaotic condition of affairs then revealed has improved only to a very slight extent. There has, it is true, been a fair amount of linking-up, and, generally speaking, so far as the technical side of the question is concerned, there is greater harmony than there was in 1905. It is only fair to add that at that time it was illegal for supply authorities to "associate," and for that state of affairs the engineers could not be blamed. The difficulties which have confronted us in London are, of course, all due to the parochial system established by the early Electric Lighting Acts, and a host of vested interests have been created which, it seems, will only be co-ordinated under compulsion. Whatever be the merits of the County of London Co.'s scheme, it is very clear that the Commissioners have a most difficult problem in front of them, and it is fortunate that under the Act of 1919 they have certain powers of compulsion. A provisional area has been scheduled as a London electricity supply area, over which, eventually, a Joint Electricity Board, in some form, will exercise control. Complete technical and administrative schemes have been called for, and March 31st next is the date by which these must be submitted to the Commissioners. The public inquiry, which is to be held as soon after that date as possible, will inevitably be a prolonged affair; and it was a wise precaution on the part of the Electricity Commissioners last May to call together all the parties concerned with electricity supply in London, and urge upon them the vital necessity of pooling their brains in an endeavour to prepare a joint scheme.

Since the Commissioners came into office they have sanctioned 150,000 KW. of extensions to existing stations, simply because they have no other alternative if the increasing demand is to be met before the much-talked-of capital station, or stations, are built, which obviously cannot be for several years. The Commissioners, who, naturally enough, have been making the most minute inquiries into the demand and means for meeting it in London, have been impressed with the shortage of plant in existing power stations to such an extent that they are seriously concerned as to the outlook during the next three or four years unless every possible step is taken to cope with the situation.

The Mystery of the Site.

To what alternative site did Sir Alexander Kennedy refer as suitable for a super-station for London? This was the question that exercised the curiosity of those present at the recent inquiry held by the Electricity Commissioners. All the information vouchsafed was that there were over 40 acres available, and that negotiations had taken place. The riddle naturally invites guessing. Although the only information given was that it was west of Barking, it is obvious that the inquiry is narrowed down to very small limits. On the north bank there is practically only the Thames Ironworks site, and as Sir Alexander Kennedy himself ruled this out, the site must inferentially be on the south side. There the low marsh land rules out a long stretch, so that no suitable sites occur until we get to the Angerstein property, and the peninsula owned by the South Metropolitan Gas Co. Higher up the river anyone would draw a blank. As the works of the Gas Co. occupy a great part of the peninsula, it seems obvious from inspection that a suitable site would be the eastern side of this peninsula looking down river, where, although the land behind is below river level, there is a broad track at the river-edge artificially banked-up. This, therefore, would appear to be the site that fits in with Sir Alexander Kennedy's hints. If anyone knowing the district can make a better guess, we shall be interested to receive it.

The I.E.E. still Homeless.

Already the outlying branches of the Institution of Electrical Engineers are beginning to bestir themselves, and shortly the great organism of over 8,000 members will resume its customary activities. The question is naturally being asked: When shall we regain possession of our own headquarters on the Embankment, and cease to be indebted to the hospitality of the Institution of Civil Engineers?

Unfortunately, no positive answer can be given. The Office of Works is in no way incommoded by its continued occupation of the handsome halls of the I.E.E., in which it has quartered the Ministry of Pensions, and, therefore, it is in no hurry to surrender the premises to its rightful occupants, in spite of the efforts repeatedly put forth by the Council to regain possession. So far as we can gather, there is no prospect of re-entry during the coming session.

On the other hand, the members will bear in mind the darksome forecast of the Past-President, Mr. Roger Smith, who indicated that the loss of revenue coincident with the return to the Embankment would necessitate an increase in their subscriptions, and find some consolation in their exile.

The attitude of the Office of Works towards the Institution is apparently in harmony with that of the Department of Scientific and Industrial Research towards scientific societies in general with regard to the cost of issuing their publications. The Department professes to be "fully sensible of the danger to scientific research which must result from a limitation of the facilities for publication," but declares that that is none of its business, and the societies must look after themselves. A grant in aid of scientific publications would be "a grant for the assistance of a particular section of the community," and as it does not happen to be that particular section of the community which the Department chooses to assist—*ça ne fait rien*.

So it is with the Office of Works; it is only a scientific society that is homeless—what does it matter? It will not be forgotten that Sir Alfred Mond wished to annex the British Museum for his myrmidons.

THE MECHANICAL DETAILS OF D.C. ARMATURE CONSTRUCTION.

By "A LONDON FOREMAN."

The following is a detailed account of the methods of construction and ultimate assembly of the elements which go to form the mechanical engineer's part of a D.C. machine, comprising the shaft, the spider, the clamping plates, keys, feathers, and coupling.

It will be shown that there are things in the mechanical, as well as in other worlds, which seem right to a man, but the end thereof is most undesirable; and the subject of this article is one of those things, which can be more easily passed or rejected, when one knows precisely the operations passed through during construction and assembly. As it is intended to deal with the mechanic's side of the subject, rather than with that of the designer, no particular design is contemplated. Various sketches, however, are given for the purpose of more clearly illustrating the points touched upon.

The Armature Shaft.—The shaft should be made of steel, of Siemens-Martin or equal quality, which, having been cut off to the desired length with a power saw, is conveyed to the lathe. It is gripped at one end in the four-jaw chuck of the lathe, and cradled in the "steady" while the turner makes a fairly deep conical impression in the opposite end with a strong centre-punch. A lathe centre kept for the purpose, fixed (as is usual) in the poppet mandrel, is applied to the conical indentation already made in the end of the shaft, and the shaft running on this temporary centre, the turner skims a few inches off the length of the shaft true and smooth. He then runs this turned portion in his "steady," and after facing the end of the shaft to the desired length, the shaft is permanently centred, with a combination drill and countersink of the well-known "Slocomb" type. The angle of the countersink and the size of the centre drill vary according to the weight of the shaft. If it is light (say, under 5 cwt.) a 60 deg. countersink and a 3/16-in. drill are used, while for shafts above that weight, a 90 deg. countersink and a correspondingly larger drill are used.

The shaft, having been suitably centred at one end, the standard poppet centre, with a dab of Russian tallow on its tip, is run up, and turning is commenced. The shaft being roughed out to within a few inches of the chucked end (if a short shaft), and within a similar distance of the necessary "steady" (if a long shaft), it is reversed in the lathe, and while it is again running in the "steady" the previously-chucked end is centred, and the end faced to dead length, and roughing out is finished. It is regarded as a truism by all first-class turners, ever and always observed, that no part of the turning of a shaft should be completed until all is roughed out.

The shaft should now be turned to within about .040 in. of finished diameters, all shoulders finished to length, and "necked" for grinder's clearance. Keyways and feather-ways are then milled, and the shaft is ground to "Newall" limits in a Landis plain grinder. Unless the shaft is urgently required, it should not be ground immediately, as far greater accuracy and dependability will be secured if the shaft is allowed to "lie around," to "breathe," and to "weather" for a time. Rolling and hammering strains are, during this time, relieved, thus preventing any departure from truth and dependability subsequent to the grinding and finishing of the shaft. It will be noted that an ultra-practical tone has been written into the above, and it is intended there should be, for though to many the turning of a shaft appears to be one of the simplest of a turner's jobs, the warped armature-shafts frequently seen bear unmistakable evidence that many turners' standard of ultimate truth is a low one.

The Spider.—Every designer of D.C. machines has his own fancies in respect of a desirable form of spider. Various designs are equally good, and as long as it can be firmly fixed to the shaft, properly support the armature core, and lend itself to conveniently fixing and controlling the clamping plates by which the core is held, little fault can be found. The writer, however, rather favours the design shown in figs. 1 and 1a, which if made with the clamping plates in steel alloy, is good and reliable as a base on which to build a durable core and armature.

Before proceeding to tell how such a spider should be prepared, and properly keyed to its shaft, it were well, it is thought, to attempt to dispose of, and for all time explode, a common error in respect of the required quality of the fit of a spider on its shaft.

Cases have been known where the spider has been bored so that it has been pushed "bang up" to its place on its shaft by hand. This is a flagrant error—an acknowledgment of ignorance of the precise requirements—and fitters should be taught that there is greater need for a force fit than exists in respect of spur, bevel, or double helical wheels and shafts. In the case of the former, the bad fitting is covered by many pounds' worth of work of core-building, armature winding, and commutator connecting, which all has to be undone if the fit of the spider gives out. In the case of the latter only that particular wheel is involved, if its fit on the shaft fails. So a spider should be as near by as possible "integral" with the shaft, and in some well-known designs shaft and spider are forged in one piece. Tight feathers do not help slack fits, but cause serious trouble, as will be shown. Let no man, therefore, pass a badly-fitted spider. If he does, "the sword of Damocles" in the shape of a doubtful armature will hang over his head, and he is bound to hear about it later. The futility of expecting a good job from a loosely-fitted spider and good fit with the feather is so obvious, too. Held at the points only, and these diametrically opposite, the feather soon gets "chewed away," the

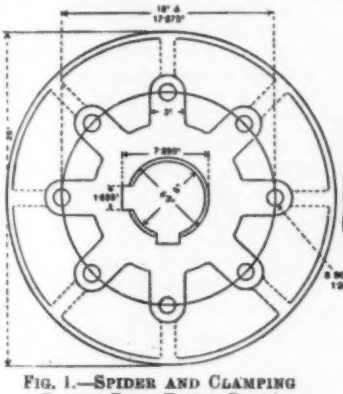

Fig. 1.—Spider and Clamping Plate, Full Taper Bore.

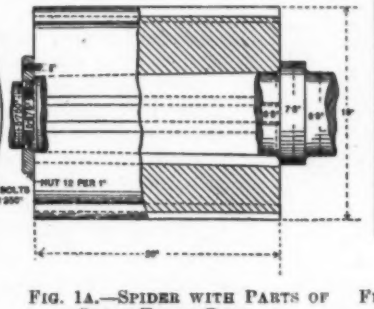

Fig. 1a.—Spider with Parts of Shaft-Taper Bore.

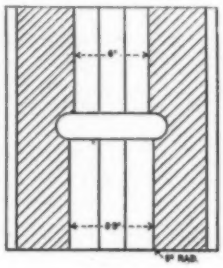

Fig. 1b.—Spider with Bore having two Diameters.

Fig. 2.—Mr. V. Pendred's Experiment.

spider will then knock at each revolution, and the more it knocks the more it will wear; and the more it wears the greater will be the knock. Damage is geometrically progressive, and the chain of destruction will extend and become complete, with armature winding and binding broken, commutator and brushes, and journal seats ruined. There is no remedy but to strip the shaft naked, skim up the shaft, re-cut the feather-ways, and fit a new feather and a new spider; *and all because the original spider did not properly fit its shaft.* The spider shown in figs. 1 and 1a has eight projections, and is suitable for an armature to carry about 1,100 amps. at 240 volts, and to run at about 475 R.P.M. The projections are provided for the purpose of holding the eight 1¼-in. dia. studs (or bolts) which control the relative position of consecutive core-plates, and which also are responsible for the tightness and hardness of the required laminated core.

Though parallel bores are strangely common among D.C. designers, for the purpose of absolute security of attachment of the spider to its shaft, I favour a bore with a substantial taper (as shown in figs. 1 and 1a). If compelled to forgo my desire for a tapered bore, I would still refuse to resort to the "full parallel," and would rather adopt a parallel bore having two diameters; for it is far easier to make a good fit of these two diameters than to draw on a spider of such a length as is shown to a full parallel, and get a good result (see fig. 1b).

Deciding on the *taper* bore, the spider should be bored, and the horns roughed out. It is then placed on the slotter, to have the two feather-ways cut.

Being passed to the fitter, the feathers should be nicely "fitted," and in that connection some straight talk is necessary. The feathers must be fitted. They must not be a "drive" fit, as they frequently are, but must just fit endwise and sideways too. Just a push fit and no more. There is only one other factor possessing greater responsibility in respect of sprung and bent shafts than a feather flogged in with a heavy hammer. "Fitting" is demanded—and nothing else will suffice.

Does not one frequently see feathers, even in much smaller shafts, loose sideways and tight endwise? A caulking tool is used to make a good fit sideways—an execrable method which later tells its tale in sprung shafts while the machine is running.

It is agreed that these advices partake of the superlatively meticulous, and though familiar to a few, are a closed book to many. Yet they are as imperatively necessary for producing a well-constructed and durable D.C. armature as any other thing in relation to it.

In fitting the spider on the shaft, let the taper be a fit, and stand a few thousandths beyond the shaft. The feathers should be just a fit sideways and on top, and the spider should be held up with a good retaining nut, held from slackening by the grubscrew shown.

It will be necessary, just here, to make a digression by a few remarks about nuts in general.

Clamping nuts for D.C. armatures are, more often than not, made on a "stock" order, and are given to lads or to equally cheap labour to face and screw. They *are* screwed, and they *are* faced, but unless the face of the clamping side is dead true with the screwed hole, and the rule is made that the unchamfered side must always face the spider, potentialities exist in that nut for spoiling shafts. There is no need to show how an untrue nut bends a shaft, for it will be obvious to every reader.

Clamping Plates.—There are various forms and designs of clamping plates to choose from, but all must possess sufficient strength to effectively harden the laminated core, by means of the core-bolts provided. They should not be abnormally heavy, should have a uniform section, and should be well ribbed on the outside. They should be turned all over on the inside—the castings being set true with the unmachinable part in the chuck. The spider having been turned to a diameter suitable for the core-plates to drop over without shake, the ends of the spider which compose the seats for the clamping plates are turned ⅛ in. less in diameter than that part of the spider on which the core-plates fit. The clamping plates are also bored to a diameter ⅛ in. less than the diameter of the core-plates, this providing a limit of distance beyond which the clamping plates cannot pass.

The method by which the half round slots in the spider are made to precisely correspond with those of the core-plates is really a shop secret; yet as the writer is the originator, it may be divulged.

There was a time in the early history of such armature design when manufacturers precisely divided out and milled the slots in which to place the spider bolts, and on which the semi-circular holes in the core-plate stampings were required to abut. The pitch, for four, six, eight, or twelve or more divisions, was mechanically divided—the makers of the machine depending absolutely on the accurate pitching of the slots in the core-plates by the stampers. But they, the armature builders, "reckoned without their host," for it happened more than once that the spider being perfectly milled beforehand, the plates came along, and were found to be not equally pitched as regards the bolt holes. So the rule should be under the circumstances to wait until the core-plates arrive, and use the plates as templates for milling the slots in the spider.

The Coupling.—It is desirable above all things that the coupling face and its spigot should run "dead true" with the shaft. The method recommended is to chuck it by the boss, and rough face the flange and edge. Reverse in chuck, and bore and finish the boss. It is then slotted, and forced on the shaft, and keyed with keys forged on stakes. The shaft and coupling is then put in the lathe, the edge and face of the coupling finished, and the spigot turned to a drilling jig. The shaft and coupling and drilling jig are then taken to a horizontal drill, and all holes are jig-drilled through hardened cast steel bushes.

By these means a perfect job is made, and if its fellow is drilled in a similar manner, a condition of absolute concentricity of adjacent shafts is obtained, far more to be desired than those resulting from the slipshod method often employed of finishing couplings in pairs, and keying each on its respective shaft, trusting to Providence to keep things true.

Balancing.—The machine we have in our mind is required to run well and truly for the term of its natural life. The shaft, with the spider and clamping plates, will therefore need to be very carefully balanced. Having no other means we must resort to static balancing, and that method with reasonable precautions will satisfy all our needs. To succeed with static balancing orthodox lines must be departed from. The usual way is to balance the assembled parts on knife edges. I balance the parts separately and then when assembled, and knife edges I have no use for. Many years ago, I had the privilege of witnessing an interesting experiment carried out by Mr. Vaughan Pendred. While following closely an investigation of the width of a flat forced on the periphery of a locomotive engine wheel, he had a polished wheel and a rail also ground and polished. He placed about 20 tons weight on this wheel. Having done that, he tried how close together he could insert gold leaf on each side of that wheel and between the wheel and the rail (see fig. 2). He could not get those two pieces of gold leaf to meet by 1⅜ in., proving that a flat existed on that wheel base all but 1⅜ in. wide.

Could I or any one else who had seen that experiment use "knife edges" to balance heavy armatures on? I use balancing strips deep and broad, and truly ground.

In concluding this purely practical article, in which appear advice and warnings so obvious, perhaps, to some as to be but a small distance removed from the region of platitudes, and which may appear to him who never thinks to be fads of no value, it is hoped that this gospel of meticulous exactitude will find its way into other shops besides those of the writer.

THE COMMERCIAL MOTOR EXHIBITION.

Held as usual at Olympia, and organised by the Society of Motor Manufacturers and Traders, Ltd., the fourth International Commercial Motor Exhibition was opened by Sir E. Geddes, Minister of Transport, on the 15th inst., and closes to-morrow. The events of the past few years having demonstrated the value of the business motor both for passenger and goods transport, have made the 1920 show the largest and most representative one that has yet been held, and this year's exhibition differs widely from the last one, held in 1913, not only with regard to the vehicles themselves, but also in connection with the accessories for facilitating the handling of the goods carried, and with passenger-carrying bodies.

The exhibition is divided into five sections, comprising in all some 207 exhibitors. Of this number, 76 firms are showing commercial vehicles, five of which firms have electrically-propelled vehicles on view; 16 firms exhibit in the body-work section; 20 in the tire and wheel section; while in the accessory and component parts section there are some 85 exhibitors, of whom about 20 show electrical accessories.

The exhibits reveal a wide range of motive power as well as of methods of application, also the possibilities of the commercial vehicle in the service of the community. The three main types of prime mover—petrol, steam, and electricity are well represented. As usual, petrol vehicles are in a numerical superiority; steam-driven vehicles come next, and show decided progress in certain directions. As for electricity, a rival to both, it has some practical representatives, usually as the sole motive power, though there is one instance of its combination with an internal-combustion engine in the form of the well-known petrol-electric drive. Alternate fuels are employed with several types of internal-combustion engines, and the purpose of the vehicles being so varied, it is not surprising that their capacities range from 2 or 3 cwt. to 7 tons. The majority are solo vehicles, but others are capable of drawing loaded trailers up to the number of three.

Time- and labour-saving properties are a feature of the exhibits; for instance, various devices for loading and unloading the vehicles, by end or side-tipping bodies, are on view. There are, in friendly rivalry, machines which effect this by their engine power, in others the tipping device is hydraulic, while last, but by no means least, electricity is relied upon in other types for the purpose, the aim being in every case the same—dispatch, time and money-saving. Very marked is the tendency towards fitting pneumatic tires on commercial vehicles. They offer the advantages of permitting higher legal speeds, and of insulating the vehicles from road shocks. Pneumatic tires are fitted to both front and rear wheels, sometimes in pairs, and at others singly, on the back wheels; in the latter case they are of exceptional size.

The accessories, which are housed in the gallery, are of much interest; a large number of commercial vehicles are now lighted electrically, the lamps being supplied either from a battery of accumulators or from a small generator. No less than 50 lorries, omnibuses and commercial cars are equipped with C.A.V. outfits, all the other British makes only total 17 amongst them. Ignition is on the magneto system, and impulse starters, which give a rapid kick to the magneto armature, are becoming more and more popular.

In the main, the exhibits are British products, but good examples of American, Canadian, French, Swiss, and Italian manufactures are on view; amongst the foreign makes American vehicles predominate.

A conference on fuels, organised by the Empire Motor Fuels Committee during the period of the show, occupied two days—viz., October 18th and 19th—whilst the Roads and Transport Section, organised by the Roads and Transport Committee, occupied the two following days. The whole of the proceedings were organised by the Imperial Motor Transport Council.

In what follows a brief description is given of the electrically-propelled vehicles and the electrical accessories that are exhibited.

Messrs. Newton Bros. (Derby), Ltd.—The "Newton" electric battery vehicle is a new-comer. The firm manufactures A.C. and D.C. dynamos and motors up to 2,000-kw. capacity, reversing planer drives, and generators for wireless and heating purposes on aircraft. The vehicle exhibited, fig. 1, consists of a 3·5-ton lorry having a platform space of 16 ft., and it is shown just as it arrived from Derby by road carrying a full load. Two motors are employed to drive the vehicle, one being geared to each of the rear wheels, thus dispensing with the differential. The motors are mounted on springs in such a manner that no road shocks can be transmitted to them except through two spring systems in series, and the motors are arranged so that they can be replaced in the minimum

Fig. 1.—Newton Electric Vehicle.

of time and without dismantling the rear axle. The final drive is through one pinion and an internal spur wheel for each motor. The controller, motors, &c., are dust-proof and easily accessible, and the whole vehicle appears to be well designed. A special body adapted for refuse collection is fitted, the tipping gear being operated by an electric motor having a 6-h.p. torque and only weighing 76 lb. Other exhibits consist of a selection of traction motor armatures and parts together with a battery-charging panel

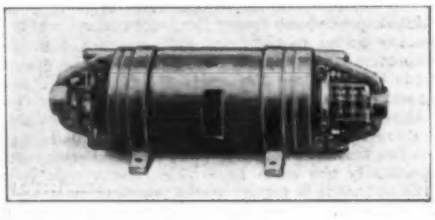

Fig. 2.—Wireless Telegraph Motor-Generator.

and motor generator. A 150-watt, 1,500-volt, 4,000-r.p.m. air screw driven generator, which only weighs 11·5 lb., is on view, together with a slightly larger machine fitted with a separate exciter to eliminate the commutator "ripple" when used for wireless telephony. A low-pressure machine for heating the airmen's clothing, &c., by electricity is also shown, as well as a motor generator of small dimensions, fig. 2, as used on board the airship R34 when crossing the Atlantic ocean. The machine is driven by a battery and only weighs 11·25 lb., its dimensions being about 12 in. long by 3 in. diameter, giving an output of 160 watts at 1,200 volts when running at 6,000 r.p.m.

Messrs. Richard Garrett & Sons, Ltd., one of the associated firms forming Agricultural and General Engineers, Ltd., are showing, in addition to several steam-driven wagons and trailers, a 3·5-ton electric vehicle, which is built generally in accordance with accepted practice. Its design possesses several good features, amongst which is the arrangement that when the vehicle is stopped, the control handle must be returned to the neutral position before it can be restarted. The single driving motor is series-wound, and capable of withstanding 300 per cent. overload. The drive is by silent chain from the motor to a countershaft, and thence by roller chains to the road wheels.

Messrs. Ransomes, Sims & Jefferies, Ltd., show two steam-driven tractors, as well as two large and two small "electrics." The latter comprise a 2·5-ton chain-driven chassis, having single reduction double-helical gearing for each of its two motors. The vehicle is a new model exhibited for the first time; it has a 12-ft. platform space, and the design follows the arrangement of the standard 3·5-tonner. A 3·5-ton tipping wagon intended for refuse collection is shown fitted with two driving motors which drive the rear wheels through chains. The vehicle is one of six similar ones sold to the Hammersmith Corporation. Turning to the smaller machines, a standard "C" type truck designed for railway work is on view; it is fitted with an elevating table operated by a separate motor, and capable of lifting 4,000 lb. on the table. A standard 2-ton factory truck of the "B 1" three-wheel type is also shown.

The General Vehicle Co., Ltd.—At the time of our visit there was only one vehicle to be seen on the company's stand, although it was intended, we believe, to exhibit the following:—A 5-ton standard chassis with "Ironclad" battery; a 2-ton standard chassis fitted with a special electrically-operated tipping wagon; and another 2-ton chassis with a special van body. Standard spare parts were also to be shown. The motor fitted to these vehicles is of the totally-enclosed series-wound type supplied by the B.T.H. Co. to the company's own design, and is suspended by a bar pivot to the side frame members just ahead of the rear axle; ball bearings are provided, and the drive is by chain. Pinion and sector steering gear, double reduction transmission, and two brakes are fitted. Five speeds are given in the forward direction, and two reverse. G.V., Ironclad, or Edison batteries may be installed at the option of the purchaser.

Messrs. Christopher Dodson, Ltd., show a single-deck omnibus body mounted on a Tilling-Stevens petrol-electric chassis, and

Messrs. Tilling-Stevens Motors, Ltd., themselves exhibit two fine petrol-electric vehicles. It will be noted that a double-laminated spring drive is employed between the engine and the dynamo. Also that a new centrifugal type of governor is employed, and that in the new chassis the rear axle carries renewable steel sleeves, on which bear the floating wheel bushes; the sleeves can be turned through 180° to present new wearing surfaces. The firm shows two 3-4-ton petrol-electric chassis, one stripped and the other fitted with a special saloon 32-seater 'bus-body, incorporating a separate driver's cabin; and a 2½-ton stripped chassis, provided with the more conventional drive, *i.e.*, four-speed-and-reverse gear-box and propeller shaft to an overhead worm-driven rear axle. Several alterations have been made in the design of the 2½-ton petrol chassis; the show model is fitted with a centrifugal type engine governor, C.A.V. electric lighting equipment and C.A.V. self-starter. The petrol-electric chassis with the saloon 'bus body is similar to the well-known T.S. 3 A type, with its 4¾-in. bore by 5½-in. stroke engine, except that the wheel-base is 15 ft. 6 in., instead of 14 ft. 6 in. Also, the steering gear is situated outside the frame, as the driver, in his enclosed portion of the vehicle, sits to the right of the dash, although his compartment does not project from the rest of the body either at the front or side. The latest T.S. 4 petrol-electric type of chassis embodies improvements; for instance, the size of the engine has been increased from 4¾ in. by 6 in. to 5 in. by 6 in., and, as in the 2½-ton model, the bottom half of the crank-case has been made removable without otherwise interfering with the engine and its alignment. One important alteration is in the carrying of the engine. It is now held in a three-point suspended sub-frame, the front end of which can rock on a bearing bolted to the front cross member of the frame. A detail improvement lies in the holding of the valve spring collars. As regards the dynamo, the cast-aluminium fan is now at the coupling end of the unit, and set within the casing on the dynamo shaft; thus placed, it is unnecessary to dismount the fan in order to remove the commutator cover, as had to be done previously when the fan was outside the unit and mounted at the commutator end. Practically the same type of electrical unit is used as a motor, except that it is turned round longitudinally, and the field coils are different. If one spare armature be carried, it will fit either unit, as the housing and brush gear are identical. Great improvements have also been made in the new axle. This, as previously, is worm-driven, the worm gear and differential being carried by the cover which forms the worm casing. Another feature is that the axle is designed to take Timken tapered roller bearings for the wheels without alteration other than the substitution of new oil throwers and the removal of the bearing sleeves; different wheels must, however, be provided. Pressed steel brake drums are employed in lieu of cast, and both brakes are of the internal expanding type, whereas, in the old models, the exterior brake was one of the external contracting type. In addition, the size of the drums has been increased, and the space between them widened, in order to give better heat-dissipating properties. As usual, the control and speed regulator are carried in separate aluminium housings. In the case of the chassis fitted with a saloon 'bus-body, these housings are placed at the driver's side of the dash.

T.S. petrol-electrics are no longer a novelty; they are sound and workmanlike, particularly suitable for passenger carrying in both flat and hilly country. All who have ridden in omnibuses or coaches of this make agree on their smooth, silent, and reliable running.

Turning, in conclusion, to the accessories and component parts section of the exhibition, the electrical equipment shown comprises: Combined and separate lighting, self-starting, and coil-ignition sets; lamps of various types; accumulators; magnetos; sparking plugs; wire and cable; electric horns; switchboards; and instruments, &c., which are exhibited by one or more of the following firms:—

Messrs. Bulpit & Sons, Ltd.; Allen Liversidge, Ltd.; Leo Swain and Co.; the Imperial Motor Industries (1917), Ltd.; Messrs. Brolt, Ltd., and C. A. Vandervell & Co., Ltd.; the Rotax Motor Accessories Co., Ltd., and Apollo Plug Manufacturing Co., Ltd.; Messrs. Joseph Lucas, Ltd.; S. Smith & Sons (M. A.), Ltd.; the British Thomson-Houston Co., Ltd.; Messrs. Conner Magneto and Ignition, Ltd.; Brown, Bros., Ltd.; North & Sons, Ltd.; Simms Motor Units (1920), Ltd.; Ripaults, Ltd.; the British Lighting and Ignition Co., Ltd., A. C. Sparking Plug Co., Ltd., and the Cooper-Stewart Engineering Co., Ltd.

The Arrota Electrical and Motor Accessories Co., Ltd.—The "Arrow" direction indicator for motor vehicles, which indicates at both front and rear, and is illuminated for night use, has undergone some improvement. The signaller, which represents a desirable accessory for car or lorry, consists of two arrow indicators, one fitted at the front, and the other at the rear of the vehicle, and each gives four signals—ahead, left, right, and stop, according to the direction in which the arrow is pointed. The device is operated by a lever, and is suitably illuminated for night use; each time the signals are made, the electric horn is automatically sounded. One insurance company is stated to give a 10 per cent. reduction on its car insurance premiums in cases where the device is fitted.

Another "gadget" is designed to enable the driver of a charabanc to hear a vehicle which has come up behind him, and whose driver wishes to pass. It is called the "charaphone," and consists of a megaphone placed in a sound box at the rear of the coach, connected by a tube to a receiver fitted beside the driver's seat.

Messrs. Eurol Patents Ltd.—The firm's electric horn operator consists of a light ring placed inside, and concentrically with, the steering wheel in such a position that the thumb of either hand falls naturally on it; a slight pressure on any part of the ring will sound the horn.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR SEPTEMBER, 1920.

The official returns of electrical exports and imports for the month of September, which we publish below, show, as regards the exports, a total of £1,145,191, which, compared with £1,085,914 for the previous month, records an increase of, roughly, £60,000 on the month's business, the increase occurring principally in electrical machinery exports, whilst average values have been well maintained in all other sections.

The electrical imports figures for September, £298,382, show a slight increase (£14,000) on the August total.

The re-exports of foreign and Colonial electrical material have shown an upward tendency for some months, the September value of £20,398 being £6,000 in excess of the previous month.

Values of Electrical Exports and Imports for September 1920.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£20,582	£92,958	£6,572
Insulated wire	326,455	17,768	1,360
Glow lamps	33,937	10,857	518
Arc lamps and parts	4,406	1,030	—
Batteries	66,441	10,796	11
Meters	38,415	11,300	6,659
Carbons	8,084	10,574	182
Electrical machinery:—			
Railway and tramway motors ...	6,052	—	—
Other motors and generators ...	146,520	—	—
Electrical machinery (unenumerated)	104,382	117,602	3,710
Switchboards (not telegraph or telephone)	12,960	216	50
Telegraph and telephone cable and apparatus:—			
Telegraph and telephone wire and cable (not submarine) ...	48,389	799	—
Submarine telegraph and telephone cable	72,992	—	—
Telegraph and telephone instruments and apparatus	75,576	24,486	1,316
Totals... ...	£1,145,191	£298,382	£20,398

SOUTH AFRICA: A NEGLECTED MARKET.

Need for British Effort.

Mr. W. G. Wickham (H.M. Trade Commissioner in South Africa), whose recent report is summarised below, was a witness during 1918 to a movement amongst manufacturers which filled him with great confidence in the future of the British engineering trade. He found works reconstructed with modern economical lay-out, and employers full of knowledge of marvellous economies resulting from bulk production and repetition work. Surprising figures of estimated output and prices for post-war products were shown him. The United Kingdom was going to give accurate, reliable British quality superimposed on the American style of cheap mass production, with a standardisation far more close than had ever been attained by rivals.

Yet Mr. Wickham finds no fulfilment of the hopes engendered by these representations. Practically none of the ground lost was regained during the first complete year after the armistice; nothing was done to demonstrate in South Africa the advances made in United Kingdom manufacturing practice and products during the war; no direct evidence was forthcoming of preparations for more systematic distribution and better methods of pushing British goods when acceptable deliveries were possible. It will not, therefore, be considered a work of supererogation to urge a few reasons why this position should be remedied. First, the work of electrifying large sections of the South African railways is to be taken in hand at a very early date. Most of the leading municipal and other power stations are not only unable to give extended service, but are still finding difficulty in coping with existing demand for current. Further, a renewal of German competition is not far distant.

Mr. Wickham refers to the impossibility in the Union of getting accurate facts as to the real increase in manufacturing cost. Generally speaking, he adds, manufacturers have made no endeavour to give any precise figures to justify sudden increases in their prices.

It seems clear that had British manufacturers been able to give delivery and to quote reasonable prices they could have done a bulk of trade in all competitive lines which would have re-established their pre-war hold on the market, and put all pre-war records of turnover into the shade. The enormous reserve stocks of German goods which some people believed to be ready to be dumped into all British markets as soon as war ended have not yet appeared. American manufacturers have, as the year progressed, been to an increasing degree handicapped by exchange rates, and British manufacturers have, to a proportionately increasing extent, been assisted in competition. For a great part of the year freight space has been not only available but actually wasted on outward voyages.

Methods of Distribution.

A second consideration which is disconcerting, and a source of disappointment relates to methods of distribution overseas. Some considerable time before the armistice a movement became visible in the direction of combines among manufacturers, either a complete fusion of interests, an amalgamation of firms manufacturing the same goods, or a looser combination of such firms merely for reducing competition among themselves by arranging prices. An alternative plan developed about the same time for combining a series of manufacturers whose products were allied or supplementary to one another's, as for instance in the electrical or the machine tool trades. A third alternative system, of which a few instances are in evidence, is to combine a series of firms which specialise on parts and components, and to set each to narrow its specialisation so as to obtain from a series of works a bulk production without any duplication or overlap of all the component parts, which are then assembled in a new joint works. These different types of combines have been formed in the course of the last two or three years, and are of the greater importance owing to the fact that a large proportion of the individual firms forming these combines have during the war enlarged and rearranged their works, systematised their methods, and increased their output considerably.

It was hoped that such steps towards economy in production would be followed at a short interval by similar efforts to reorganise and produce greater efficiency and economy in distribution. There has, however, been little indication that the study of this big question has yet been undertaken.

The large amalgamations, combines, and price agreements of the last few years are, of course, not confined to the engineering trades, but it is those which are concerned with different branches of engineering, such as agricultural and electrical machinery, wire ropes, steel, machine tools, railway locomotives and rolling stock, motor cars, &c., which are chiefly concerned with the question of scientific distribution. In most of these trades, so far as this market is concerned, distribution has been in the past of necessity expensive, if not faulty and extravagant. In many, there has been no sort of co-ordination of effort except possibly—and so far as the manufacturer is concerned, fortuitously—through the uncontrolled initiative of the agent.

In each and all of these lines the competitive representation of many makes made highly-paid and technically-qualified experts on the spot almost an impossibility, while even the addition of large percentages of remuneration left no very considerable profit to agents on the small turnover. In the electrical trade, again, we were in competition with a few very large, and very highly organised, firms, organised as highly for publicity, for study of local conditions and needs and for distribution, as for manufacture.

All of these could, without any waste or extravagance, afford to have their own sales organisations on the spot and ample qualified specialists in every branch of the industry. The very much smaller British firms, which, for the most part, fail to obtain economy in manufacture, owing to spreading their energies over a wide range of goods simultaneously, were unable to secure adequate efficiency or economy in distribution. Being in competition with five or ten manufacturers each had to have separate representation. Not all could find really technically qualified representatives. In order to provide an adequate turnover many of the local merchant agents had to take on agencies in far more branches of engineering than they could really do justice to. At the very best the system involved an enormous duplication of effort, both in technical staff and in travelling canvassers, in office premises and in staff.

In view of the foregoing considerations, it was natural to suppose that the newly-formed amalgamations would show effort towards the study of local conditions and systematising representation in the South African market. H.M. Trade Commissioner has seen no direct evidence of such initiative. He says:—

"From the point of view of United Kingdom manufacturers, practically none of the ground lost during the war has been regained during this first complete year after the armistice; still less has anything been done to show the advances made in manufacturing practice and products during the war. In many directions ground has been lost; and it may almost be surmised that if Germany had been able to compete, and if America had not been handicapped by exchange rates, it would have been found difficult for the United Kingdom even to keep the leading place as a supplier of goods to South Africa."

Demand for Electrical Plant.

As regards electrical plant and supplies, reports received from public bodies all tend to indicate that there is still a shortage, and that plant on order for very long periods has not yet been delivered. Most of the leading municipalities are not only unable to give extended service in respect of electrical current, but are still, with difficulty, coping with existing demand with no reserve for emergencies. With regard to electrical goods, the market has been glutted with certain lines, such as lamps which were over-imported in 1918 by speculators, but in most lines, such as heating and cooking apparatus, telephones, conduits, &c., supplies have been at times unprocurable at any price. One municipality reports finding it cheaper to use high pressure steam pipe than ordinary electrical steel conduit.

Apart from the difficulty of getting delivery of machinery against old contracts, it has been found almost impossible during the year to place orders in the United Kingdom. In spite of the adverse rate of exchange, America has taken practically every important order for large plant owing to the apparent inability of British manufacturers to quote firm either for delivery or price.

At the present time public bodies are faced with the choice between paying what seem prohibitive prices and turning down all schemes for extended activities.

Imports of Machinery and Supplies.

The total importation of electrical machinery and supplies for the year was £969,379 in value. Of this, £430,000 went to the United States and £460,965 to the United Kingdom. It is disturbing to note that orders for insulated cable, far from being confined to the United Kingdom, went to America to the extent of 22 per cent., and that Japan took a further 9 per cent., valued at £24,000. Even so, the United Kingdom retained hold of this trade more effectively than in other branches of the electrical trade. The total values of the imports of electrical goods, other than cables, for the year 1919 were as follows:—

United States	£366,000
United Kingdom	279,000

Detailed comparison with previous years is not possible, as it is only this year that the imports have been fully shown under detailed headings. The following figures indicate, never-

theless, the serious hold on this trade obtained by the United States manufacturers in spite of adverse exchange rates in 1919:—

	Per cent.		Per cent.
Batteries, primary and secondary	83	Motors	47
Heating and cooking apparatus	58	Transformers	72
		Machinery, other	65
		Material, other	33

In machinery and engineers' supplies (not electrical) again there is keen and increasing competition from the United States in many lines, such as boilers, traction engines, &c., in which previously the United Kingdom stood alone. The total importation of articles included in this group is £2,469,832 and of this America contributed £1,071,914.

The following are the main sub-heads, with the American percentage:—

	Per cent.		Per cent.
Air compressors	60	Other manufacturing machinery	32
Belting, leather	44	Mining (£405,000) ...	56·7
Belting, other	44	Printing	53
Battery cloth	30	Pumps (Switzerland, 24 per cent.)	28
Boilers	17·7	Sawing	54·5
Cranes	30	Water boring	92
Lifts	30	Windmills	89
Engines, traction and roller	80	Other	39
Fire engines and appliances	45		
Oil engines...	54		
Machine tools	66		

The South African Association of British Manufacturers and their Agents was formed at a meeting held in Johannesburg in December, 1919, on the lines of the Australian Association, the value of which to British manufacturers has been tested and proved during the past nine years. It is to be hoped that manufacturers will support this organisation, formed, as it is, solely to look after their interests, and depending for its utility largely on the voluntary efforts of their South African representatives.

It is the intention of the Association ultimately to have branches in Johannesburg, Cape Town, and probably Durban, working primarily through sections representative of each separate trade.

STANDARDISATION IN GERMANY.

By E. S. H.

With the necessity for intensified production in Germany and the hopes that industry may at some future date recover the position attained before the war, German manufacturers have given a good deal of attention during the last few years to the question of standardisation.

Realising what had been accomplished in Great Britain and America in the way of standardisation, manufacturers, technical societies, and corporations decided that the time was ripe for similar endeavours in their country. The result was the formation of the German Industrial Standards Committee, which is constituted on very much the same lines as our own Engineering Standards Committee. There are numerous main committees and sub-committees to deal with specific subjects, and the co-operation between certain engineering societies and industrial firms is very close.

Already over 200 draft specifications have been issued, these being mostly on the mechanical and building material sides. Up to the present I have not seen any definite programme outlined for electrical work, but here also the need for intelligent standardisation is recognised, and no doubt a commencement will soon be—if it has not actually been—made. The need for standardisation of voltages and frequencies in electrical plant has long been recognised, and many tentative schemes have been submitted with a view particularly to standardising frequency, both as regards central stations, in view of the proposed inter-linkage of water-power and steam stations, and consumers' motors, &c.

The Society of German Engineers is specially active in the field of standardisation, and publishes an organ which is very largely given over to the publication of draft specifications and suggestions and to general matters bearing upon the question of standardisation.

In the electrical field, standardisation is especially urged because of the possibility in the future of the exchange of energy between Germany and neighbouring countries.

MERCURY-VAPOUR TURBINES AND BOILERS.

As an engineer, William Le Roy Emmet, to whom in May last the Edison medal was awarded "for meritorious achievements in electrical science, electrical engineering, or the electrical arts," represents a rare type of man. For 33 years, during which time he has taken out 105 patents covering electrical and kindred apparatus, he has worked earnestly towards the mastery of the obstacles that lie between engineering theory and its practical application, and, moreover, he has shown originality, tenacity, and fearlessness in his work. To the fact that he has never hesitated to depart from regular practice must be attributed a large measure of his success, and his present work upon the mercury-vapour boiler and turbine is an example which, according to the *Electrical World*, promises to revolutionise steam-driven electric generating plant practice, and to result in economies beyond the most sanguine estimates.

In his response, following the presentation of the Edison medal, Mr. Emmet recalled his early engineering experiences, and commented upon the problem of mercury-vapour turbines. He did not go into details, but stated that he was at present engaged upon the perfecting of a turbine of this type which had given highly efficient results. He said that the overall thermal efficiency of the mercury-vapour turbine equalled that of the Diesel engine, and, when the firing conditions were up to the standard of a large central-station boiler room, energy could be produced on the basis of 11,300 B.TH.U. of fuel consumed per KW.-hour.

It has long been the aim of engineers to improve the efficiency of heat engines by increasing the temperature range through which they work. There are two ways of accomplishing this desire; first, by lowering the temperature of the exhaust, and secondly, by raising the temperature of the supply. The former minimum is limited by the temperature of the available cooling water, while the latter maximum is limited by the temperature of combustion of the fuel and the properties of steam. Further, at reasonably high temperatures the pressure of steam becomes too great for convenient commercial use, because of the difficulties of mechanical construction.

Many unsuccessful attempts were made to find substitutes for steam; the next suggestion was to use two substances in series. A liquid having a high boiling point was to be vaporised in a boiler, used in an engine or turbine, and condensed in a condenser which also acted as a boiler for a second liquid having a lower boiling point than that of the first. The second substance was to be used in an engine and condensed as usual. The proposition, however, involved new difficulties on account of the complicated apparatus necessary and the chemical properties of the various substances proposed to be used.

Contrary to popular opinion, Mr. Emmet was of the opinion that the scheme was a workable one, and six years ago he devised a binary-vapour apparatus which made use of mercury vapour and steam. The intervening time has been utilised to perfect various details, and on the occasion above referred to Mr. Emmet is reported by *Power*, from which the following information is abstracted, to have stated that commercial application was being made of the system, and he hoped that it would meet with commercial success in a very short time. Moreover, there is a persistent rumour that an Emmet mercury-vapour plant is being built for the Hartford (Conn.) Electric Light Co., which was the company that installed the first steam turbine in the U.S.A. for electric power generation.

It is claimed that Mr. Emmet's apparatus cuts down, by a very appreciable amount, the loss of available heat, which results from the big temperature drop from the furnace to the water in the ordinary boiler. In other words, it increases the amount of heat that may be transformed into power and decreases the amount that must be thrown away in the condenser cooling water. Thus, the energy per unit of fuel in the central station will be greater. In the industrial plant using exhaust steam for heating or steam at any pressure for processes, power may be taken out from that part of the temperature range which has been unavailable.

Mercury boils and condenses exactly like water except that its density is much greater and its boiling temperature much higher. At atmospheric pressure mercury boils at 677 deg. F., and condenses in a 28-in. vacuum at 455 deg. F. The corresponding temperatures for water would be 212 deg. F. and 101 deg. F. respectively. Briefly, Mr. Emmet's scheme is as follows: Mercury is boiled in a boiler similar in principle to, but differing greatly in detail from, an ordinary steam boiler, and the mercury vapour produced is used to run a turbine. The exhaust from the mercury turbine is condensed in a form of surface condenser, which is also a boiler. The heat given out by the condensing mercury vapour evaporates the cooling water, and this steam may be used to drive another turbine or for any other purpose. The chief difficulties seem to be the large amount of mercury needed and the danger of leaks, as mercury vapour is very poisonous.

Fig. 1 represents diagrammatically the elements of Mr. Emmet's apparatus. The products of combustion from the furnace pass upward through part of the tubes which form the heating surface of the mercury boiler, and then forward among the remainder. These tubes are connected to the

lower mercury chest, which might be called the mud drum in a steam boiler, and to the mercury header corresponding to the steam drum in an ordinary boiler above. Mercury vapour at about 10 lb. gauge pressure is collected in the header and passes through the pipe shown to the mercury turbine. Owing to the high density and low spouting velocity of the mercury vapour the turbine may be a single-stage machine, of reasonably low speed, and may have short buckets. The wheel may be placed inside the mercury condenser for simplicity.

The mercury condenser consists of a tank, as shown, supporting another tank marked "steam drum." A number of straight tubes extend from the bottom of the steam drum down into the condenser. The exhaust from the mercury

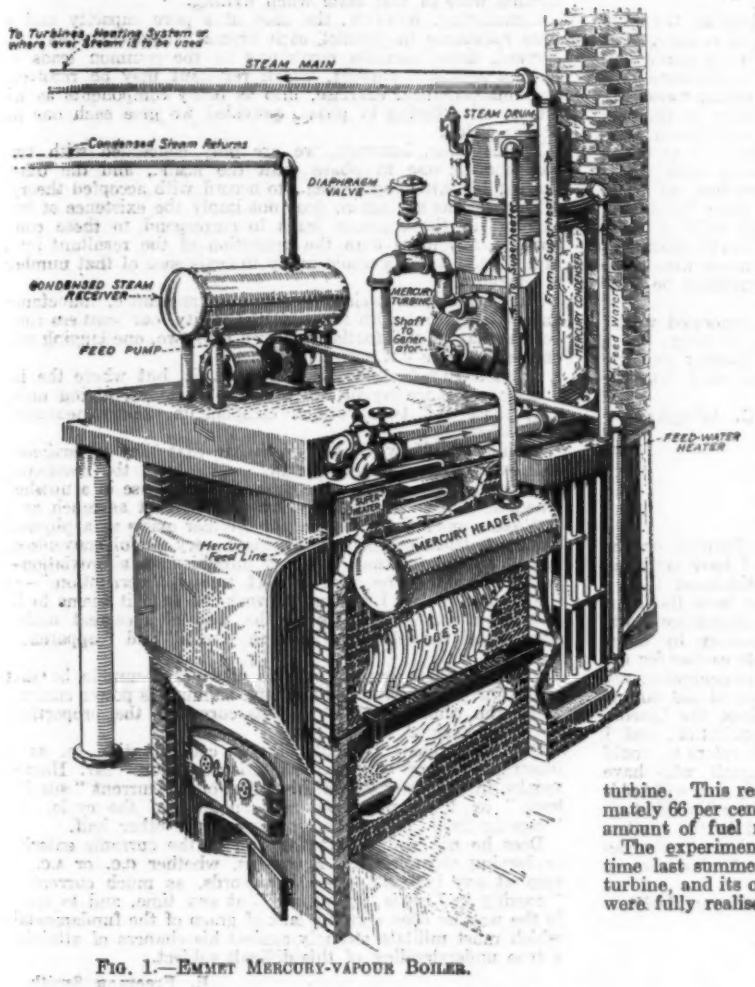

FIG. 1.—EMMET MERCURY-VAPOUR BOILER.

turbine is condensed on the surface of these tubes, and as the boiling point of the mercury at 28 in. vacuum is 455 deg. F., steam may be generated inside the tubes. Circulation in the tubes is provided by smaller tubes inside them, leading from the steam drum, which corresponds to the upper drum of a water-tube boiler. The steam that is generated in this condenser-boiler is led through the pipes marked "to superheater" through the superheater, and finally through the steam main to wherever the steam is to be used. The steam condensate, whether from a steam turbine or engine, heating system, or manufacturing process, is returned to the condensed steam receiver. From here it is pumped to a feed-water heater, which is really an economiser. The feed-water heater is shown in the illustration directly below the mercury condenser. From here the water returns to the steam boiler, thus completing its cycle.

The mercury condensate is drained from the bottom of the mercury condenser to the lower mercury header and thence to the mercury boiler. The high density of mercury renders a feed pump unnecessary, as by setting the condenser above the boiler the latter can be fed by gravity.

The foregoing covers the general principle of the apparatus, but certain refinements seem necessary for its practical application.

The quantity of mercury that would be required if an ordinary steam-type boiler were used would make the cost prohibitive. For this reason a special type of boiler had to be designed to give a maximum heating surface and at the same time require a minimum amount of mercury. The designs for the boiler proper called for the use of flattened tubes for the elements of the boiler. This shape of cross-section gives much more heating surface with less volume of liquid than a circular tube would give. Experiments are now going on to determine the necessary proportions of such elements to provide for proper liquid circulation and release of vapour.

The question of preventing leaks was a serious one. The mercury parts of the outfit are run at low pressure so that there is a minimum tendency to leakage, and means are provided to condense and save all mercury which leaks from joints. The diaphragm valve, shown on the mercury-vapour pipe near the mercury turbine, is simply a safety relief valve, and instead of discharging into the open air, discharges into the mercury condenser.

The temperature of the mercury in the boiler is so high that the temperature of the flue gases leaving the tubes would be much too high for economical operation if they passed directly to the stack. To avoid such losses the flue gases, after leaving the tubes of the boiler, pass over a mercury pre-heater (not shown in the illustration), then over the steam superheater, and finally over the feed-water heater or economiser, and then to the stack. In this way the temperature of the gases entering the stack can be made as low or even lower than would be possible with a steam-boiler plant of the ordinary type.

A steam turbine is not an essential part of this device; the intention is to afford a substitute for the existing boiler. The steam may be used as it now is for any desired purpose. The mercury acts as a conveyor of heat from the furnace to the steam, and incidentally delivers a certain amount of power as a by-product. A large part of the power generated in the mercury turbine is net gain, as it comes in part from heat that would otherwise be rendered unavailable by the great drop in temperature between the furnace gases and the steam.

Another advantage of this process is that the interior of that part of the boiler exposed to the fire is always perfectly clean. Also the boiler in which steam is generated is subject to no large temperature differences.

Mr. Emmet claims that by the addition of this device to a modern power station, with an increase of 15 per cent. in the amount of fuel used, the same amount of steam can be supplied to the steam turbine as under present conditions, and the mercury turbine will generate power equal to about 66 per cent. of the power generated by the steam turbine. This results in a gain in station capacity of approximately 66 per cent. with an increase of only 15 per cent. in the amount of fuel required.

The experimental equipment was in operation for a short time last summer with over 1,000 KW. load on the mercury turbine, and its operation showed that the economies predicted were fully realised.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Domestic Supply Pressure and Wiring.

With reference to the letter from Mr. E. Ellis in your issue of October 8th, it appears to me to be hardly necessary, in most cases, to run C.T.S. cable for house wiring in steel tubing, where it is buried in plaster, in order to protect it from nails. Switches are generally near the corners of rooms, and if the vertical run to a switch be run in the extreme corner, the risk of a nail being driven into it is negligible, since no one hangs pictures in the very corners of rooms. Other runs which have to be buried under plaster, to brackets, for instance, can often be run in corners of chimney-breasts, for instance. Cab-tire sheathing resists chemical or electrolytic action when buried in plaster far better than steel tubing, which often becomes more or less rusted or corroded, and then can no longer be relied upon as a protection to the wires against nails or other damage. Even when new, C.J. steel tubing does not invariably resist nails, especially if the joint is outwards. If the use of steel tubing can be avoided, not only is the cost of the tubing saved, but chasing of the brickwork is avoided.

When running under floors, across the joists, it is better to bore through the centres of the joists with a short auger, rather than notch the top of the joists. By this method the wire is kept out of the way of nails; trouble is sometimes caused by nails in floors being driven through steel tubes,

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which have to be laid across the tops of the joists. It may be said, therefore, that C.T.S. cable, if properly run, is even better protected against nails than steel tubing; it is more out of the way of gas and water pipes, which are invariably laid across the tops of the joists; it gives better protection against damp, and against chemical and electrolytic corrosion, and is less likely to cause trouble or fire by earthing on to gas pipes.

The labour is not much increased by boring the joists instead of notching them; it may even be less in cases where wiring is done, in new houses, after the floors have been laid but before the ceilings below have been lathed. The joists are commonly bored in running electric bell wires, when this is done in the cheapest possible fashion. There is the incidental advantage that the joists are weakened less.

The method mentioned by Mr. Ellis of looping the twin cable from the supply into the lamp points, and running twin cables from these to the switches, is very often a convenient and economical one. The use of porcelain connectors can, however, be saved by using three-terminal ceiling-roses, one terminal being used to connect the switch-wire to the live main; where the point is controlled by two switches a four-terminal ceiling-rose is required, and these, as well as three-terminal roses, are commercial articles. In some cases, where the switches of several rooms are close together, as on a landing, it saves cable to loop the live twin from the supply into the switch-points, running a twin from each of these to its lamp. Porcelain connectors under the switch-pattrasses then have to be used, since switches are not made with extra looping terminals, nor would such an arrangement be altogether desirable.

But why not use single C.T.S. cables for concealed work? They cost a little more than half the price of twin, but a good deal of cable can usually be saved by looping one live wire into the lamp-points and the other live wire into the switch-points, in the usual way.

G. C. Allingham.

London.
October 13th, 1920.

Electric Welding.

With reference to the letter of Mr. J. W. Beswick on the above subject in your issue of October 8th, I have certainly no desire to mislead your readers. The statement that a differentially-wound compound generator must have its shunt winding separately excited is in my own experience quite correct. The fact is apparently found necessary by other makers and investigators who all use a separate exciter for the shunt winding, or, in the case of a D.C. motor-generator, use the motor current for the same purpose. One of the largest makers of single-arc reverse compound machines, the Lincoln Co., of America, always employs separate excitation, and I could name others. The machine Mr. Beswick refers to would be of extreme interest to others besides myself who have experimented in this direction. I am sorry he withholds technical particulars, and I hope he will change his mind on this point. I am quite open to be convinced in the matter, and would be the first to tender congratulations to the designer. Until that time, however, I fear I must adhere to my original statement.

H. Bevan Swift.

London.
October 11th, 1920.

Single-phase Meters on Three-phase Systems.

I am grateful to Mr. Thomas A. Robertson for his reply to my inquiry under the above heading, and wish to thank him for it.

Stop Watch.

October 11th, 1920.

Power Factor.

Mr. C. H. Harvey's reply to my criticism of his former letter on the subject of power factor calls aloud for comment.

There is probably no other problem met with on the practical side of electricity supply, on which so much misunderstanding exists, as on that of power factor. Believing as I do that criticism and discussion tend towards elucidation, I trust I may not be thought to be prompted by a carping spirit in the remarks which follow.

It is to be regretted that many of Mr. Harvey's statements leave much to be desired on the score of clarity; notably so where he says: "The term wattless current is in order when speaking of R.M.S. values, &c.," in the earlier part of his letter. With the best will in the world, I am quite unable to make anything of this, except on one hypothesis, which, however, I hesitate to accept.

Mr. Harvey goes on to point out that I do not show any increase of current due to the low P.F. A study of several series of curves, such as I advocated, will show that apparatus working at a low P.F. requires a larger current than that of higher P.F. for the same power. To say, however, as he does, that: "The plant as it works at lower P.F. . . . does give rise to an extra current" is, to put it mildly, absurd.

I should like to say, in passing, that the method I gave of showing the effect of lagging or leading currents was not intended to be thought original, it being given, as Mr. Harvey says, in text-books, although I omitted to say so.

Going on to the case of the condenser next mentioned, we "add to our condenser circuit across the same supply, but by separate leads, a resistance. Now," he says, "bind the leads together" (whatever that may mean) "so that the resistance is across the condenser with common supply," that is, I take it, in parallel. But were they not in parallel before?

Such a statement of conditions forces me to one of two conclusions: Either, in attempting to understand this, I have become like Mr. Harvey's two currents "in some way mixed"; or else his own ideas concerning arrangements of circuits were in that state when writing.

Considering, however, the case of a pure capacity and a pure resistance in parallel, each branch would carry its own current, these currents combining in the common leads to form a resultant current, which resultant may be resolved, as a mathematical exercise, into as many components as we please, all differing in phase; provided we give each one its proper value.

In this case, however, we are only concerned with two components; one in phase with the E.M.F., and the other leading the E.M.F. by 90 deg., to accord with accepted theory.

This, let me say again, does not imply the existence of two currents in the common leads to correspond to these components, any more than the resolution of the resultant into, say, six components would imply the existence of that number of currents.

Furthermore, in a circuit containing resistance, inductance and capacity, but with P.F. less than unity, our wattless component may be still further resolved into two, one lagging and one leading the E.M.F. by 90 deg.

To go a step further, in such a circuit, but where the inductive reactance equals the capacity reactance, giving unity P.F., these last two wattless components exactly neutralise each other.

Would Mr. Harvey have us believe that they nevertheless still exist as separate or "extra" currents in the resultant?

Unconsciously, perhaps, he puts the whole case in a nutshell when he says: "A wattless current can exist as much as a wattless component." Exactly! Neither exists as a physical fact, "wattless component" being a very useful convention, and "wattless current" a very mischievous abbreviation—perhaps it would be more correct to say "corruption"—of the former term. I say mischievous, because it seems to be a common stumbling-block in the way of a correct understanding of the difference between "real" and "apparent" power.

An idea which has fairly wide credence seems to be that of the current shown on an ammeter so much is power current, while the remainder is "wattless current," the proportions being determined by the P.F.

One other point I should like to call attention to, as it illustrates a very widely-spread misconception. Mr. Harvey speaks, in the latter part of his letter, of the current "surging back" on the generator during one-half of the cycle, and "coming from" the generator during the other half.

Does he not realise that the sum of the currents entering or leaving any electrical apparatus, whether C.C. or A.C., is zero at any instant? In other words, as much current is "coming in" as is "going out" at any time, and to speak in the way he does argues a lack of grasp of the fundamentals which must militate strongly against his chances of attaining a true understanding of this difficult subject.

E. Freeman Smith.

Dunfermline.
October 15th, 1920.

Joint Industrial Councils.

If I am not "too late for the fair," I should like to make one or two comments on the leading article which appeared in your issue of the 8th on the above subject, especially in its relation to the editorial paragraph relating to "Specialism on Labour Questions." I should like to endorse the views expressed in a later paragraph against the suggested "specialists" on labour questions. Mr. Madgen suggests, I understand, that special officials should be employed to deal with labour questions and to sit on the employers' side of the Industrial Councils. With all deference to Mr. Madgen, I would suggest that in making this suggestion he has not fully considered the point in its relation to the spirit of the Councils. I agree with the ELECTRICAL REVIEW that such a proposal is in essence directly opposed to the fundamental principles underlying the whole system of Whitleyism. The unions on the Councils deal directly with the employers, and not through "specialists," and this practice must continue. It is indeed the building-up of mutual confidence *through personal relationship* (that is, meeting one another face to face), which is the first of the purposes of the Councils. If this fails, or is abjured by the employers' side, the Councils are only a waste of time. We had much better meet in the industrial courts on formal arbitration lines, or put the strike weapon into operation.

May I explain our own special point of view? In consenting to form these Industrial Councils, we did so because we considered that they were quite a logical consequent on the prin-

ciples on which our unions themselves exist. Our unions were formed to do away with selfish industrial individualism. We stand for the principle which in every department of life is becoming more and more widely recognised every day, namely, that "no one lives to himself alone," that the good of the individual is, in the last resort, bound up with the good of the whole body.

We are literally a "union," a body whose foundation is common interests, and the union exists as much to protect the whole against any selfish individualism of its members (as in the case of a man underbidding his fellows in the labour market) as it does to protect its members against unfair treatment by employers. This is its negative side. Its positive side is to further the interests of the industry it is related to, as a whole. The more prosperous the industry the better for everyone. I am of the opinion that the precepts of Whitleyism have gone further than their founder imagined or intended. It has given to the trade unions concerned a very large portion of the control of industry to which they (or, at any rate, the Electrical Trades Union) aspire. Progressively, therefore, the next step is naturally some kind of union of the trade unions with the employers' unions to work for the common good. This is, of course, at present an ideal only, but this is where the Industrial Councils come in. They are the first experimental steps in the evolution of some more organic co-operation. The work already done in this direction is, as shown in your admirable leading article, not without fruit and promise. But while we, following our principle of co-operation and union, are willing to go forward on the lines of the Industrial Council, we have no use for meetings with "specialists" who simply come to us with briefs from employers "in the background." The men who sit on the opposite side of the table on the two District Councils, of which I happen to be the secretary of the trade unions, are "specialists," but certainly not of the type suggested by Mr. Madgen. They are "specialists" of the industry, as are the representatives of the E.T.U., and both sides look at the subjects under review from the standpoint of the industry, and not from the purely legal standpoint.

If I may put it bluntly, if any man "employs" other men, he cannot get out of a *personal responsibility* with regard to the welfare of such men. The time has passed when in any reputable industry he can limit his interest in his business simply to the profit in cash he gets out of it. As an employer, by that very act, he *makes* a sociological problem, and as an employer, therefore, he has got personally to help towards the solution—he must make time for it, and in the electrical industry he cannot do this better, at present, than by way of attending an Industrial Council.

In conclusion, I am of the opinion that the value of the District Councils depends upon their decisions being loyally carried out by the undertakings concerned. Moral pressure has had to be used several times recently, and not always with success, and the only thing left is for the trade unions to take trade union action. Therein lies the danger to Whitleyism: A case in point: Epsom Urban Council has refused to carry out a recommendation of No. 10 Council in respect of wages. A deputation from my Committee (London District, E.T.U.) also failed to obtain redress, and now there is nothing left but to withdraw our members. But the Epsom undertaking could very easily get "blackleg" labour sufficient to carry on, and the Electrical Trades Union could not stand by helplessly and see its Epsom members starved out, and would have to call upon all the members employed by undertakings in No. 10 Area Council to come to the assistance of the Epsom men. One wonders what the Review would say then. Believe me, Mr. Editor, the Electrical Trades Union is more often sinned against than sinning.

W. J. Webb,
London District Secretary of the E.T.U. Secretary, Trade Union Side, Nos. 9 and 10 District Councils, for the Electricity Supply Industry.

London.
October 18th, 1920.

[We have supported the Electrical Trades Union before, and we will support it again, when it is fighting for the due observance of the award of an Industrial Council, or any other (to our mind) legitimate object. We oppose it only when we believe its aims to lack that quality. We are pleased to find ourselves at one with Mr. Webb in respect of the whole of his letter.—Eds. Elec. Rev.]

Credit and Prices.

My attention has just been drawn to the comments on this subject which you reproduced on page 433 of your issue of October 1st from the City Editor's notes in the *Times*.

As this newspaper did not publish the correspondence upon which its City Editor commented, it may be of some interest to those of your readers who have perused your notice to read the letters to which the City Editor of the *Times* so courteously replied.

I have sat upon Labour Councils, and the complaint has always been that it is this section of the community that bears the brunt in such times as these. If sudden deflation brings about extensive unemployment it will, in my opinion, take a clever economist to induce labour to sit quietly and listen to a lecture proving that empty stomachs are necessary to reduce the cost of living. It is for these reasons that, in the solution of this problem, I advocate a measure of forethought, which I hope may serve to spare us from fruitless regrets when it may be too late.

Edward Berkeley.

London.
October 16th, 1920.

September 21st, 1920.

The Editor of *The Times*, Printing House Square, Qn. Victoria Street, S.W.1.

Sir,—I have read with interest your leading article of yesterday morning in regard to the outlook of prices, but regret I do not share some of the views expressed by the writer. I do not believe that the business community as a whole considers that bankers deliberately refrain from extending credits. On the contrary, it has appreciated the efforts which have been made by those responsible for our large banking institutions in the way of assisting the re-equipment of factories and in the re-establishment of industries upon a peace-time basis. It quite understands that bankers' efforts in this direction are, of necessity, limited by the resources at their disposal. If it has become fashionable to blame bankers for the reaction in trade, the fashion cannot be attributed to misconceptions on the part of the public such as those alleged. The reason for it must be sought elsewhere.

When the Armistice was declared, many long and able speeches were made by chairmen and directors of our leading Joint Stock Banks, and they are fresh in the minds of business people. They expressed optimism in regard to the prospects of industry, and promised that when the time came the necessary credits would be forthcoming. Reports of these speeches appeared in almost every paper in the country, and commercial and industrial centres were soothed into a sense of false security, and enthused into somewhat premature optimism. Manufacturers, resting upon the assurances that they would receive from their bankers the financial support and credit they desired, produced what they were told was necessary for the world's welfare. The sudden withdrawals of credits which had been extended to them, the demands made by the Government for the payment of excess profits duty, and the delays in deliveries of raw materials due to industrial strikes throughout the country have left producers in a state of uncertainty as to what is going to happen next. Business men are sitting on the fence; meantime, prices are rising higher and higher.

How are restrictions of credit going to reduce prices? Before the war the world required a certain amount of produce; to-day the requirements are certainly not diminished; meantime, its stocks have been depleted. To replace stocks costs double or treble what it did in pre-war days. If, therefore, credit is not going to be extended to meet this enhanced cost, it will result in a greater shortage of the necessities which the world demands. Certainly the withdrawal of promised credits, if there was no demand, would tend to bring down prices, but there *is* a demand, in view of which the cure proposed is worse than the disease.

If the coming winter brings extensive unemployment, the general interests of the country are likely to be menaced by something far worse than the inflation of currency about which we hear so much to-day.

Yours faithfully,
EDWARD BERKELEY.

September 24th, 1920.

Sir,—Permit me to preface these few remarks with my expressions of sincere appreciation of your courtesy in having replied to my letter of the 21st inst., through the medium of your "City Notes," which appeared in your issue of yesterday under the heading of "Credit and Prices." I am afraid, however, that your answers do not yet convince me, for the following reasons.

Compulsory liquidation of unsold goods, though it may temporarily provide the holder of commodities with working capital, almost invariably results in a loss to the holder and diminishes his productive and earning capacity. To this loss in productive capacity the producer must add the loss occasioned by the withdrawal of the credit facilities hitherto enjoyed by him. For these reasons I am of opinion that a sudden restriction of credit, when the world's stocks are depleted by nearly five years of war, must necessarily mean a restriction of productive power. Further, restriction of credit would not necessarily compel liquidation of stocks, it would far more likely result in the transfer of stocks from weaker to stronger holders and ultimately result in the consumers paying higher instead of lower prices.

As regards your final remarks, I am entirely in agreement with you that the price of an article is determined ultimately by what the buyer is prepared to give for it, and the other factors (such as the cost of production) have to adjust themselves to that price, but this point is hardly material to our argument.

I have no desire whatever to "administer a fresh dose of inflation to the economic patient" if it can be avoided. If it is contemplated to bring "pressure on prices via unemployment" the dose will still have to be administered whether we like it or not, for it seems to me that Government subsidies and unemployment doles cannot, any more than extra production, be obtained without *temporary* inflation of the currency.

Aggravation of inflation is probably inseparable from heavy production, and the latter, in my view, is the only real cure for the economic patient of to-day.

Those who can continue to pay high prices are the minority. The majority of buyers are necessarily the actual workers or producers. If, due to unemployment, they find themselves unable to remain purchasers, they must either accept doles, or become thieves, or go without. I hold, therefore, that since we must have a certain amount of inflation, whichever way it is produced, either by Government borrowing or by extra production, I would choose the lesser of two evils as the safer and cheaper physic for my economic patient. A devil-take-the-hindermost policy is dangerous.

Yours faithfully,
EDWARD BERKELEY.

Electric Vehicles in India.—After travelling to Shillong from Ganhati by motor car, one is disposed to regret, says *Indian Engineering*, that the railways to both Simla and Darjeeling were permitted to interfere to such an extent with the cart roads to those hill stations from the plains. Simla has apparently established a strong and abiding faith in the advantages of electricity for lighting, heating, cooking, and power generally. But there is to be very much more progress in the near future. Mr. F. L. Milne, the municipal electrical engineer, took leave home last year, and was deputed while on leave to go into the question of adapting electric vehicles to conditions of running on the Simla roads. He gave a good deal of time to the study of the subject, and on his return made his recommendations to the Simla municipality. As a result the municipality has now decided to order the chassis of a one-ton electric lorry which will be equipped with a 'bus body suited for carrying about 12 passengers, to be run between Simla and Mashobra as an experiment. Should the venture prove a success, as anticipated, electric vehicles for running in and about Simla will be introduced on a considerable scale. Some years ago Mr. Milne was working on a scheme for introducing electrically-driven rickshaws into Simla, and the scheme might have matured but for the war.

TELEPHONE ENGINEERING IN THE U.S.A.

The president of the Institution of Post Office Electrical Engineers, Sir W. Noble, M.I.E.E., engineer-in-chief to the British Post Office, addressing the London Centre of the Institution last week gave some impressions of his 33 days' visit to America in 1919.

Sir William said, *inter alia*: We had, prior to our arrival, arranged meetings with the engineers of the A.T. and T., Western Electric, Automatic Electric, and the Western Union Telegraph Companies. We visited exchanges, telegraph offices, research laboratories, and factories, besides attending conferences, and meeting U.S. Post Office officers to obtain information on the subject of Government control of the telegraphs and telephones during the war period. The marked developments in telegraph and telephone engineering especially appealed to us. While development in these matters was practically at a standstill in this country during the war period, American engineers were preparing plans to apply the most up-to-date improvements throughout their system, and to replace their exchange plant in all the large cities by the automatic system.

One feature of their organisation, which impressed us most at the outset, was their unique and extensive provision for research in all branches of telegraph and telephone science, and there is no doubt that America's foremost position is largely attributable to the generous policy which has been followed in this matter.

The general introduction of automatic exchange working is probably the main feature in their scheme of progress, and we gave special attention to this matter, discussing it with telephone experts at all the cities we visited, and finding a practically unanimous opinion that full automatic working is the only certain method of ensuring the quality of service now demanded by the public. One group of experts only were dissentients, and whilst they were as keen on replacing the present method of manual exchange operating, they held the view that the subscriber should not be trusted with the dial, and that the best method was one based on semi-automatic principles. The auto-manual service at Lima, Ohio, is undoubtedly the best which came under notice; the opinion is held, however, that the rapid service is attributable to the absence of metering and junction working, due to the tariff being entirely a flat rate one, with 99 per cent. of local traffic. These conditions are also those which would probably ensure still greater efficiency with a full automatic system.

During the inquiry into automatic working, it was found that the Western Electric Co. had designed its "panel" system to operate with a dial having the impulse scheme similar to that of the A.T.M. Co.'s system in this country. As all the existing exchanges in America are of the latter type (Strowger), this uniformity will simplify the arrangements for dialing where different types of full automatic are in use. This will probably be most beneficial in connection with dialing distant automatic exchanges from "Toll" boards.

In this country there are at present three types of dials, each with a different scheme of impulses, viz., A.T.M. Co., Siemens, and Western Electric Co.'s rotary. It has now been decided that all systems supplied for use in Great Britain shall in future be designed to operate from a dial with an average speed of ten impulses per second, the break portion of each impulse being within the limits of 60 per cent. to 66 per cent. of the complete impulse. This will accord with the standard adopted in America, and is similar to the arrangements in use in this country at all exchanges constructed by the Automatic Telephone Manufacturing Co.

Before the visit to America, the existence of the Western Electric Co.'s automatic system at its three semi-automatic exchanges in Newark, New Jersey, was known to the Department's engineers, but it was understood that its operation had not been altogether satisfactory. The investigations made last November proved that the defects which existed on the original panel equipments in Newark had been remedied by improvements in design, and that the American Telephone & Telegraph Co. was not only convinced that full automatic working was the most economical method of effecting telephone communication in large cities, but was satisfied that the advantages of the "Panel" type were sufficiently outstanding to merit its use entirely in large multi-office areas, such as New York and Chicago, the conditions of which may be said to correspond with those at London, Liverpool, Manchester, Glasgow, and Birmingham.

The impression obtained from the investigations made of the panel equipment, and the facilities available, were so favourable that I managed to persuade the American Telephone and Telegraph Co. to give me the option of purchasing a 3,500-line equipment of the "Panel" type, so as to enable British Post Office engineers to be in a position to get down to the details of the panel equipment simultaneously with the telephone engineers in America, thus preventing this country from lagging behind in actual experience as regards latest practice, and arrangements have now been completed to introduce it in London, G.P.O. South, where it will form the nucleus of a 10,000-line exchange.

Telephone experts are unanimous in their opinion that the panel system is the only one which is capable of fulfilling the many requirements of a large telephone area, especially during the stage of transition.

The estimated total number of telephone stations owned by the Associated Bell Companies of America on September 30th, 1919, was 7,201,757, and 3,790,568 additional stations, owned and operated by other companies, are also connected with the Bell system for toll service. There are besides in the United States 1,012,000 stations owned by various independent companies not connected with the Bell system. The grand total for the whole country at the date mentioned was thus 12,004,325, representing an average of one telephone to about ten persons.

The long-distance system is at a high level of efficiency both with regard to rapidity of service and quality of transmission. The distances between the commercial centres of the United States make an efficient long-distance service relatively of greater importance than in Great Britain. For instance, New York and Chicago, the two principal cities, are nearly 1,000 miles apart; correspondence by post is, therefore, relatively slow, and consequently a rapid means of communication afforded by an efficient telephone service is well patronised by the business community. As a matter of fact, the delay on calls between New York and Chicago is rarely in excess of 20 minutes. The transmission is generally excellent, and the average equivalent of New York-Chicago lines is about 10 miles of standard cable between test boards.

One of the most notable features of the long-distance system is the New York-San Francisco service, which is provided by means of three circuits. These cities are 3,400 miles apart, yet speech over the telephone lines is comparatively easy. The line conductors are No. 8 B. & S. gauge, hard-drawn copper. Each weighs 435 lb. to the mile, making the total weight of copper in the line 2,960 tons. Each of the three circuits (two physical and one phantom) is loaded, and is worked through six repeater stations.

A Post Office engineer, visiting the States for the first time, cannot help marking the general absence of trees along telephone routes. The poles are generally untreated timber and creosoted poles are conspicuous by their absence. Arms are very long and carry ten wires, the spacing between wires and between arms being wider than in our practice. Neither the poles nor the arms are earth-wired. Glass insulators are used almost exclusively; porcelain insulators are, however, used in some sections of the trans-continental line. But perhaps the most remarkable feature is the extensive use of aerial cables, not only for local services, but for long-distance services. Aerial cables are frequently used in America in circumstances under which underground cables only would be permissible in this country.

Even the main trunk cable between New York and Chicago is erected on pole lines throughout, except in some short sections through cities. The loading coils for aerial cables are generally suspended on the poles by a steel crane construction. American engineers claim that aerial cable construction for main lines is cheaper in first cost and more stable in maintenance than underground cables. Our experience in this country, on the other hand, is exactly the reverse. Electrolysis is a serious source of trouble with underground cables in America, and aerial cables are not entirely free from risk of damage from that source. Owing to the frequent occurrence of high voltage power lines paralleling telephone lines special measures for protecting the latter from dangerous induced voltages are necessary. Joint use of pole lines for telephone, electric lighting, power distribution, and even tramway trolley wires, is quite common practice.

Some reference must be made to the extensive underground cable system of the Associated Bell Companies. In the larger cities, the central exchange area distribution is entirely underground, and in New York and Chicago, for example, the cable plant dwarfs even the present cabling of London. New York is connected on the south with Philadelphia and Washington by an underground trunk cable route, and similarly with Boston on the north; the total length of the route from Washington to Boston is nearly 500 miles, and a multiple duct is laid throughout. American methods of underground cable route construction differ in some details from British practice, and appear to be more costly. In jointing the cables no provision is made for desiccation either during construction or in maintenance, and the same practice is followed in aerial cable work. The present standard of insulation for main cables is 500 megohms per mile, which is remarkably lower than the British standard of 10,000 megohms.

In the loading of cables American practice is almost identical with our own. The loading coil with the iron wire core has been entirely superseded by the coil with a "solid" core. This solid core is built up of disks of hydraulically compressed iron dust, and its outstanding advantage as compared with the iron wire core is its electrical stability. It cannot be permanently magnetised, and its permeability is not affected by excessive currents from ringing machines, testing batteries, telegraph signals, &c.

The loading coils now being installed in the London-Manchester trunk cable have cores of this type which will be the standard for the future. The success of the long-distance service in the United States has been very largely due to the

extensive use of loading coils; but the New York-San Francisco service and long-distance service generally on the light gauge cable routes has been made possible only by the development of the telephone repeater. This development has become almost revolutionary since the introduction of the three-electrode thermionic valve.

The address was illustrated with a number of diagrams and lantern slides.

LEGAL.

Stobie v. Newcastle-on-Tyne Electric Supply Co.

The action brought by Mr. Victor Stobie, carrying on business as the Stobie Steel Co. at Dunston-on-Tyne, against the Newcastle-on-Tyne Electric Supply Co., was mentioned on Tuesday, October 12th, the opening day of the current legal term, to Mr. Justice Peterson in the Chancery Division.

The action came before the court on an application made by Mr. Tomlin, K.C., appearing for the Electric Supply Co., with regard to the taking of an account directed by a judgment of his Lordship in April of last year, in relation to profits made by Mr. Stobie in his business. His Lordship, in his judgment, had held that under certain agreements the Electric Supply Co. was entitled to a share of the profits in question.

The arguments of counsel and the evidence of witnesses occupied the court during June 9th, 10th, and 11th last, when the case was adjourned until the 14th of that month; but on the 15th a further postponement was granted on the application of Mr. Tomlin, with a view to a settlement, and the case stood out of the list.

Counsel now stated that the settlement had not yet been arrived at, and the parties were desirous that there should be a further adjournment with a view to arranging certain matters in dispute.

His Lordship assented, and the case stood further adjourned *sine die*.

A Discount Dispute.

In the City of London Court, on Tuesday, before Mr. Registrar Wild, a claim was made by Mr. George Braulik, exporter of electrical supplies, 8, Lambeth Hill, Queen Victoria Street, E.C., for £1 5s. 9d. for goods supplied to Messrs. Watshams, manufacturers of electrical accessories, Howard House, Arundel Street, Strand, who raised a counter-claim for £2 16s. 7d., balance of account for electrical goods supplied.

Mr. Harry Strouts appeared for the plaintiff, and Mr. Borrodaile represented the defendant.

The dispute concerned the counter-claim which was in respect of discount which the defendant alleged had been wrongly deducted from the account. There was an amount due from the plaintiff of £113 4s. 6d. which, according to the terms of business was subject to monthly account 2½ per cent. Plaintiff had paid £110 7s. 11d., deducting the 2½ per cent., but as the account was not paid within the time it was wrongly deducted.

Mr. Strouts said that the defendant had given a clean receipt for the amount of the cheque which the plaintiff had sent, but for the defence it was said the receipt was not one given in full settlement. Mr. Strouts said that the defendant's account was subject to a contra account for goods which the plaintiff might supply.

Registrar Wild said he considered the receipt which had been sent by the defendant was a clean receipt, and he was of opinion at the time the cheque sent by the plaintiff was treated as a settlement of the account. But for the plaintiff's present claim nothing would have been heard of the counter-claim. Judgment was entered for the plaintiff upon the counter-claim.

Marconi Wireless Telegraph Co. v. Hamilton.

In the Chancery Division, on Wednesday, October 13th, before Mr. Justice P. O. Lawrence, Mr. Douglas Hogg, for the plaintiffs, applied for a speedy trial of this action in which the plaintiff company sought to restrain the defendant, who was formerly in their employ, from disclosing to the shareholders the terms of a deed entered into between the company and himself. Counsel suggested Wednesday, October 20th, as a convenient date.

His Lordship said that defendant must be ready for trial on that day.

[As we go to press we learn that the action was settled, all charges against Mr. Hamilton being withdrawn.]

British & Allied Electrical Agency, Ltd., v. Chemical Engineering Corporation, Ltd.

In the King's Bench Division, on October 14th, Mr. Justice Bray had before him an action brought by the British and Allied Electrical Agency, Ltd., of 13, Victoria Street, Westminster, against the Chemical Engineering Corporation, Ltd., of Parliament Mansions, Westminster, in which the plaintiffs sought to have set aside a contract entered into between themselves and the defendants, on the ground that they were induced to enter into it by misrepresentation of material facts. Defendants denied misrepresentation.

Mr. Croom Johnston, for the plaintiffs, in opening the case, said fraud was not alleged. The action related to adhesive tape. In December, 1918, an agreement was made between the parties under which the defendants were to supply to the plaintiffs 50 tons of this tape at 1s. 6d. per lb., quality to be as per the sample submitted. Defendants forwarded the goods direct to the plaintiffs' customers, all of whom made complaints regarding the material.

At this stage a conference took place between the parties, and Mr. Johnston announced that terms of settlement had been agreed between them, and he asked that a Judge's order be made staying the action and ordering the payment of money out of Court, £60 to the plaintiffs' solicitors, and £60 to the defendants'.

His Lordship assented to the course proposed.

BUSINESS NOTES.

Bankruptcy Proceedings.—H. Turner, electrician, 31, St. Paul's Road, Southsea.—The following are creditors herein :—

Edison Swan Elec. Co.	£31	Lawrance, Ltd.	£20
Simmons Bros.	23	Southey, James	12

Harrison & Sons, electrical engineers, 93, Princes Street, London Road, Southend-on-Sea.—Receiving order made on October 11th, on creditors' petition.

Foster, Skinner & Co., electric fittings dealers, 6, South Castle Street, Liverpool.—Receiving order made October 14th on creditor's petition.

Company Liquidations.—Lowa Engineering Co., Ltd., electrical and mechanical manufacturers, 25, College Hill, Cannon Street, E.C.—Pursuant to the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held recently at the offices of Messrs. Thomas Keens, Shay & Co., I.A., when it was reported that Mr. A. J. H. Shay had been appointed to act as the liquidator of the company. An extraordinary meeting of the shareholders had previously been held at Mapesbury Works, Willesden Lane, N.W., when a resolution was passed to the effect that the company could not, by reason of its liabilities, continue its business, and that it was advisable to wind up the concern voluntarily. Mr. Shay submitted a statement of affairs which showed liabilities amounting to £3,665 11s. 5d., of which only £687 17s. 5d. was due to trade creditors, the balance of £2,977 14s. being in respect of cash claims. The assets were estimated to realise £1,068 5s. 8d., from which had to be deducted £152 11s. 4d. for preference claims, leaving net assets of £915 14s. 4d., or a deficiency of £2,749 17s. 1d. The assets were as follows :—Cash at bank, £29 4s. 1d.; book debts (good) £56 17s. 5d.; bad and doubtful book debts, £268 4s. 8d., expected to produce £149 1s. 7d.; stock in trade valued at £480 6s. 6d; and plant and machinery, £728 17s. 7d., estimated to realise £459 13s. 6d. It was stated that last March it was understood that debentures for £2,000 would issued to secure cash advanced, but as a matter of fact, no charge had been given on any of the assets. After discussion, the creditors decided to confirm the voluntary liquidation of the company, with Mr. Shay as liquidator, and an informal committee of two of the largest trade creditors was also elected. The principal trade creditors are :—

Improved Solidite Co.	£62	Sterman, Knight & Co.	£105
Owen, B.	250	English Electric Supplies, Ltd.	80

Electrolytic Co. (Spain and Portugal), Ltd.—Winding up voluntarily. Liquidator, Mr. R. I. Marsden, 5, Moorgate Street Buildings, E.C.

Commercial Electrical Accessories, Ltd.—Winding up voluntarily. Liquidator, Mr. N. Bell, 78 and 79, Wool Exchange, E.C.

Masham & District Electric Supply Co., Ltd.—Meeting of creditors is called for October 27th, at the Town Hall, Masham. Liquidator, Mr. T. E. Thwaites.

British Electrical Accessories, Ltd.—Particulars of claims must be sent to the liquidator, Mr. W. A. Judge, 72, Market Street, Bradford, by November 30th.

Dissolutions of Partnership.—Youett, Reed & Co., electrical and mechanical engineers and contractors, 89A, Godiva Street, Coventry.—Messrs. F. E. Youett, F. Reed, F. H. W. Moore, and H. T. Moores, have dissolved partnership. Debts will be attended to by Messrs. F. E. Youett, F. H. W. Moore, and H. T. Moores, who will continue the business under the style of F. E. Youett & Co.

Electric Lamp Replacement Co., electric lamp dealers, 83, Fleet Street, E.C.—Mr. W. J. Head and Mr. J. D'A. Steele have dissolved partnership. Debts will be attended to by Mr. W. J. Head, who will continue the business.

Imlay & Bland, coachbuilders, motor, electric and general engineers, London Road, Oadby.—Messrs. G. A. Imlay, W. Imlay, and E. Bland, have dissolved partnership. Messrs. A. and W. Imlay will attend to debts.

Butterworth & Robinson, electrical engineers, 20, Bold Street, Southport.—Mr. A. B. Butterworth and Mr. J. A. Robinson have dissolved partnership. Debts will be attended to by Mr. A. B. Butterworth.

Shire Arc Welding Co., electric welders, 36, Peas Hill Rise, Nottingham.—Mr. J. Horton and Mr. G. H. McMillen have dissolved partnership. Debts will be attended to by Mr. G. H. McMillen.

Tucker & Bateson, electrical engineers and factors, 55, Berners Street, W.—Mr. S. J. Tucker and Mr. R. L. Bateson have dissolved partnership.

Bewick, Moreing & Co., mining engineers and mine managers, 62, London Wall, E.C.—Messrs. C. A. Moreing, W. J. Loring, A. H. Moreing and E. A. Loring have dissolved partnership.

Catalogues and Lists.—Messrs. Bagshaw & Co., Ltd., Dunstable Works, Dunstable.—An illustrated leaflet announcing the manufacture of chains for elevators and conveyors, and for driving purposes.

Messrs. Berry's Electric, Ltd., 86, Newman Street, W. 1.—A priced and illustrated leaflet dealing with the "Asku" patent shade-tilter.

Messrs. Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C. 2.—A very substantial binder containing a large number of leaflets illustrative of the peace-time products of this company. The leaflets are illustrated by means of exceptionally clear photographs, and deal chiefly with complete transmitting and receiving sets of various types, including installations for ships. All apparatus is very fully described, and diagrams of connections are given in practically every instance.

The Ironclad Switchgear Manufacturing Co., 61, Vincent Parade, Balsall Heath, Birmingham.—Priced leaflet illustrating the "Vincent" ironclad Home Office fuse.

Ironclad Switchgear Co., Ltd., Eccles Mill, Monton Lane, Eccles.—Illustrated catalogue (8 pp.) dealing with ironclad switch and fuse gear. Fully priced.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Specification No. 133 (8 pp.). Illustrated description of G.E.C. oil switches, "Type VII," with details of mechanism, tank, &c. Catalogue F 1 Section. "Industrial and Street Lighting Fittings and Accessories" (44 pp.).—An illustrated price list of reflectors, lanterns, well-glass and bulkhead fittings, hand lamps, pillars, switches, &c. The catalogue is prefaced with some very useful illuminating engineering data. Also Leaflet H 2,361 illustrating and describing "Magnet," Model "A" electric fires with removable elements.

Messrs. Crompton & Co., Ltd., Chelmsford.—Leaflet C1, illustrating and describing small D.C. motors of protected, open bracket and totally-enclosed types. Priced.

The Macintosh Cable Co., Ltd., 22 & 23, Jewin Street, E.C. 1.—A booklet containing four pages of reproductions from actual photographs of sections of impregnated paper-insulated cables of various areas and types.

Trade Announcements.—Mr. F. S. Wyatt announces that he has succeeded to the business of his father, the late Mr. W. A. Wyatt, electrician, of 14, Maristow Street, Westbury (Wilts.).

Messrs. Marshall & Co., electrical engineers, have opened a new establishment at 41, Carlisle Road, Bradford.

National Engineering Supply Co., electrical and mechanical engineers, of West Bute Street, Cardiff, have opened a branch office at 36, Queen Street, Neath (Telephone 315 Neath), where they are carrying large and varied stocks of electrical and mechanical supplies. The branch will be under the management of Mr. L. Gwyn Thomas.

The name of the "Central and South American Telegraph Co." has been changed to "All America Cables, Inc." The address—viz., 34-36, Broad Street House, New Broad Street, E.C.—remains unaltered.

A Cardiff Exhibition.—Manufacturers from all over the country are announced as among the exhibitors at a South Wales "Health and Home" Exhibition, which is to be held in the Drill Hall, Dumfries Place, Cardiff, from January 26th next to February 5th. The feature of the exhibition will be the display of labour-saving appliances in the domestic sphere, including demonstrations of house lighting and heating systems, and methods of preparing and cooking food. The organising manager, Mr. Ewart Watson, has opened offices at 37, St. Mary Street, Cardiff. Local manufacturers and traders are agreed that exhibitions such as this will do much to assist in the development of Cardiff as the natural shopping centre of the large and densely populated surrounding districts.

Electrical Contractors' Association.—At a meeting of the Electrical Contractors' Association (Incorporated), held at the Hotel Metropole, Leeds, on October 13th, Mr. Percy Collinson, president, in the name of a large number of members of the Council and of Sectional Councils, presented Mr. E. C. Wallis, Fellow and ex-president of the Association, with an illuminated testimonial bearing many autographs, in token of the general appreciation felt for services rendered in Council and otherwise to the Association's interests during nearly 20 years.—*Yorkshire Post.*

Receiverships.—Bastian Electric Co., Ltd.—Mr. T. G. Haward was appointed receiver for the debenture-holders in this company on October 6th; creditors' claims for goods supplied up to that date will remain in abeyance pending future developments.

Electro-Galvanisers, Ltd.—Mr. W. S. Morgan, of 18, St. Swithin's Lane, E.C., ceased to act as receiver-manager on October 6th, 1920.

Book Notices.—*Faraday House Journal*, Vol IX, No. 1; Michaelmas, 1920. The current issue of this well-known house organ contains, in addition to the usual supply of notes and notices, a discussion on the subject of insulating materials and an article by Dr. A. Russell, principal, on "The Insulation Resistance of House Wiring."

"The Toronto Hydro-Electric System." The ninth annual report (1919) of the Toronto Electric Commissioners (31 pp.). Toronto: The Bryant Press.—Includes financial statements for the year and diagrams illustrating capital expenditure and growth of revenue.

"Installation News." New series. No. 5 (16 pp.). Simplex Conduits, Ltd., Birmingham.—The October number contains "Help for the Worried Wireman," notes on cables, &c.

"Prospectus No. 8, University Engineering College, Westgate-on-Sea."—Giving particulars of courses in preparation for examinations for B.Sc. degree, &c.

The Technology Reports of the Tôhoku Imperial University, Sendai, Japan. Vol. I, No. 3 (24 pp.). Tokyi: Maruzen Co., Ltd. This issue is a paper on "The Energetics of Telephone Receivers."

"Annual Report of the Board of Regents of the Smithsonian Institution for the Year ended June 30th, 1917." Washington: Government Printing Office."

"Rudiments of Electrical Engineering." By P. Kemp. Pp. xviii + 255, figs. 93. London: Macmillan & Co., Ltd. Price 6s.

"*Proceedings* of the Physical Society of London." Vol. XXXII, part 5. August 15th, 1920. London: Fleetway Press, Ltd. Price 4s.

"Post Office Electrical Engineers' *Journal*." Vol. XIII, Part 3. October, 1920. London: Electrical Review, Ltd.

"A Course in Electrical Engineering." Vol. I. "Direct Currents." By C. L. Dawes. Pp. xiv + 496, figs. 365. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

"The Metropolitan-Vickers Gazette," No. 90, pp. xii. + 23. Price 7d. post free. The September issue of this magazine contains as a frontispiece a portrait of Mr. H. Mensforth, late general manager of works, and a brief sketch of his career. An interesting article on "Porcelain for the Electrical Industry," is contributed by Mr. W. S. Flight, and Mr. G. A. Cheetham writes "A Few Notes on the Limitation of Output."

"*Journal* of the American Institute of Electrical Engineers." Vol. XXXIX, No. 10. October, 1920. New York: The Institute. Price $1.

Western Electric Co.'s Exhibition in China.—The Western Electric Co. is fitting out a houseboat at Shanghai, which will make a tour of the rivers and canals of China this winter. The boat will contain practically all the latest electrical labour-saving devices to be found in American homes. It will carry a complete line of household devices, including motor-driven sewing machines, vacuum cleaners, irons, and washing machines, as well as the labour-saving electrical apparatus used by American farmers. —*Reuter's Trade Service* (New York).

German Commercial Activity in China.—According to the *North China Daily News*, the German engineer, Kocher, who was recently nominated director-general for the whole of China on behalf of the German electrical firm of Siemens, has contracted to supply the machinery necessary for the exploitation of a colliery near Hang Chow, in spite of the fact that Germany maintains her inability to manufacture such machinery for the restoration of the French coalfields. Moreover, Kocher has ordered from Germany a quantity of electrical tramway and factory equipment and other plant, severely undercutting English, French, and American products. Kocher was one of the most active German propagandists in China during the war, but thanks to Chinese influence he was not repatriated.—*Reuter's Trade Service* (Shanghai).

Tangier.—In a special article on the trade and industry of Morocco in the *Board of Trade Journal*, it is stated, on the authority of Mr. H. B. Johnstone, H.M. Vice-Consul at Tangier, that there is an opening there for British electrical plant and accessories.

Trade with West Indies.—H.M. Trade Commissioner in Trinidad calls attention to the serious inconvenience caused to importers there by the non-receipt of invoices or bills of lading at the time that the goods arrive. It is stated that this happens with many consignments of goods from the United Kingdom. It is understood that owing to shipping difficulties it has been difficult for exporting firms to dispatch the necessary documents at the right time, but, as the local banks facilitate the clearance of goods consigned to firms of any standing, it is suggested that an advance invoice would meet the case. This could be prepared and dispatched immediately after the packing-room had reported that the consignment was made up.—*Board of Trade Journal.*

South African Electrical Market.—The *S.A. Mining and Engineering Journal* for September 25th states that business in the electrical material trade appears at the moment to be very quiet, and there are no outstanding features to report. Materials continue to arrive freely, and with the exception of gasfilled lamps, which are very scarce, there is no shortage of any lines; even pear pushes and rosettes, which, until quite recently, were unobtainable, are now fairly plentiful. Prices remain much the same, with, however, a tendency, on account of the present glut of materials, to go lower. No contracts of importance have been announced, nor have any considerable orders been received from other parts of the Union for some time.

An Absurd Strike.—There was a curious dispute at Liverpool, last week, involving electric lift constructors and joiners. The battle-ground was the new premises of the Liverpool Co-operative Society, and because the electricians erected lift guides, which the joiners considered was their work, the latter came out on strike. It was usual for the company who supplied the lift to send their own men to erect it. After being on strike for nearly a week, the joiners returned on condition that their men were paid for standing by while the guides were fixed, and the demarcation should be settled by the Court of Arbitration.

There is a great amount of unemployment amongst Liverpool electricians, owing to the action of the shipwrights, who have been on strike just on 10 weeks. Ships for repair are being diverted to other ports, and some firms have reduced their electrical staffs to one-eighth of what they were three months ago.

Payment by Results.—Messrs. Armstrong, Whitworth & Co., having produced figures to the Tyne District Committee of Engineering Unions demonstrating the impossibility of competing for locomotive engine orders in the open market under the present system of production, and having in view the immense unemployment which would result from orders going elsewhere the District Committee has agreed to meet the firm on the proposal to introduce piece-work.—*Daily Dispatch.*

Miners' Wages.—According to a statement issued by the British Commonwealth Union, average earnings in three key industries are :—

	Pre-war.	1920.
Coal mines ...	£95,000,000	£272,000,000
Railways	61,000,000	167,000,000
Textiles	95,000,000	262,000,000

Average increases per head work out at 183 per cent. for the miners, against 176 per cent. for railwaymen. The "cost of living" last July had gone up by 152 per cent. on July, 1914.—*Daily Dispatch.*

Electrical Golfing Society.—The twelfth meeting, under the auspices of the Birmingham Electrical Golfing Society, was held, last week, at Streetly, Sutton Coldfield, and Mr. C. R. Hough (handicap 3) won the Dr. Railing Cup with a score of 81—78 net; Mr. W. E. Lancaster and Mr. J. H. Harpin being second and third with 70 and 80 net respectively.

Anti-Dumping Bill.—According to the Parliamentary Correspondent of the *Daily Telegraph*, another Bill for the prevention of dumping and the protection of key industries has been drafted by the Board of Trade. It is intended to replace the measure which was introduced last year and was dropped at the end of the session. The new Bill, it is understood, has not yet been before the Cabinet, but it is expected that it will be presented to Parliament this autumn.

For Sale.—Halifax Corporation Tramways and Electricity Committee has for disposal one 750-kw. d.c. generator coupled to a Corliss valve engine, and four Babcock & Wilcox water-tube boilers. For particulars see our advertisement pages to-day.

Catalogues Wanted.—Mr. J. H. Meiklejohn, A.M.I.M.E., engineer to the Austral Bronze Co., Botany Road, Alexandria, Sydney, New South Wales, wishes to receive catalogues from makers of machinery, &c., for producing and working non-ferrous metals.

Joint Board.—The first meeting of the newly-instituted Industrial Joint Board for No. 2 area, for employers and technical and clerical staffs in the electrical industry, was held at Huddersfield on October 13th, Mr. H. Lupton (Leeds) being elected chairman, and Mr. W. Redmayne (Electrical Power Engineers' Association) deputy-chairman.

An Order for Germany.—According to the *Electric Railway and Tramway Journal*, an order has been placed with a German company for the supply of generating plant, motors, switchgear, and other electrical apparatus, to the value of £155,000 or more, for a large works in the North of England. A large gas engine for the same works was ordered in France, and for steel-work foreign prices were £9 per ton lower than British.

Domestic Electrical Exhibitions.—Prior to the war the Hornsey Electricity Department erected a sub-station building at Muswell Hill, but was unable to secure delivery of the motor-converter plant for installation. It is quite a large building, and during the war was leased to Mr. R. W. Paul as an instrument factory. For some time it has been standing vacant, and to put it to some use the Electricity Department conceived the idea of using it for another exhibition of electrical apparatus for use in the home, similar to that held about two years ago. Under the management of the borough electrical engineer, Mr. W. Staniland, this project took shape, and a number of local electrical firms co-operated to make the exhibition a success, and the result was a very imposing array of apparatus. Practically every modern product was represented on the dozen or more stands composing the exhibition. There were "Hoover" and "Eureka" suction cleaners; "Magnet," "Sullivan," "Revo," "Belling," and "Helix" fires, and several types of electric irons, grills, toasters, boilers, immersion heaters, a "Hotpoint" sewing machine, &c. Messrs. Charles E. Beck & Co., Ltd., of New Bond Street, had a "Thor" washing machine in operation, and there were also "Rotapex" and "Red Star" washers among the exhibits. A feature of the "Thor" machine was a slipping clutch device—the "Atalog"—which renders the motor safe from overloading. Messrs. Berry's Electric, Ltd., had two "Magicoal" fires installed in an alcove—making a very effective display. The opportunity afforded by the show was seized by the E.D.A., which had a large selection of propaganda leaflets on every stand, and

Exhibition at Hornsey.

it was understood that Mr. Beauchamp, the secretary and director of the Association, was giving lectures on at least one evening. Mr. Staniland also lectured on the advantages of electricity, &c. The local firms exhibiting examples of their stock were: Messrs. C. H. Ekless, E. Wight & Co., J. W. Carpenter, Shepperson & Dooley, E. C. Goodfellow, and Arthur Godman; the Electricity Department also had a stand in the centre of the main hall. The Engineering and Lighting Equipment Co., of St. Albans, displayed a quantity of shop-lighting equipment in the show windows in the front of the building. The exhibition was to close on October 16th, but there seemed a general desire to extend the time by at least a week.

A similar display is in progress at the show rooms of the Westminster Electric Supply Corporation at 6, Eccleston Place, Belgravia, S.W. 1. This company, which serves between 15 and 17 thousand consumers, is inviting visitors to witness demonstrations of washing machines, vacuum cleaners, &c. Many types of electric fires have places in the exhibition, including Quead, Belling, Bastian, and a "Magicoal" fire, by Berry's Electric, Ltd., as well as two constructed by the company itself, the "Westminster" 2-kw. size, and the smaller 1-kw. "Westminster Baby." The laundry appliances include a "Thor" washing machine and an ironing machine by the same makers. In the cooking section are electric stoves by Vickers, Carron, Berry's, and Bertram Thomas. Cookers are hired out by the Corporation at the low charge of two guineas per annum, and fires at 10s. 6d. The low rate fixed for electricity for power and heating purposes (1½d. per unit) should put these appliances within the reach of a large circle of consumers.

The Corporation of Wolverhampton, with the co-operation of local electrical contractors, is also holding an exhibition of domestic electrical appliances from October 18th to 30th at the Electricity Department's show rooms. Addresses on "Electricity in the Service of the Home" are being given each afternoon.

Mexican Oil.—The *Board of Trade Journal* quotes passages from a report on the petroleum industry in Mexico prepared by the Latin-American Division of the U.S. Bureau of Foreign and Domestic Commerce, which emphasises the enormous importance of Mexico in this respect. The report states that although in 1913 Mexico supplied only one-fifteenth of the world's production of oil, in 1918 it furnished more than one-eighth. The actual quantities produced are given as 25,902,439 barrels (of 42 gallons) in 1913, and 63,828,327 barrels in 1918, out of a total world production of 384,667,550 and 514,729,354 barrels. The supply for the year 1919 showed a still further advance, amounting to 87,359,533 barrels. In spite of the magnitude of these figures, it is estimated that they only represent 12 per cent. of the country's potential production, that is, if every well had been permitted to flow without restraint of any kind the total output in 1919 would have reached 547,000,000 barrels, or several million barrels more than the aggregate supply of 1918 from all countries. The combined area of the oilfields now being exploited in Mexico does not exceed 800 square miles, but a report of the Mexican Petroleum Department places the zone of possible production in the Gulf Coast States at about 80,000,000 acres, on the Pacific at about 50,000,000 acres, and in Lower California at about 18,000,000 acres, making a total of 148,000,000 acres, or 230,000 square miles. The invasion of salt water in several important fields has arrested development in these areas, but it is thought that this will give an impetus to the opening up of other fields, particularly the known areas further south. Ninety-seven per cent. of the investments in the oil industry of Mexico are held by foreigners, by far the largest owners being Americans. In 1918 there were 27 companies producing oil in commercial quantities. Of these 17

were American, producing 73 per cent. of the total output, five were owned by Spanish-American interests, and produced 2 per cent., three were Dutch, with a production of 4 per cent., and the remaining two were owned by British interests, and contributed 21 per cent. of the total production. The production of oil in Mexico is limited by the transportation facilities available, and it is estimated that given adequate transportation, the present monthly shipments of 6,000,000 barrels could be increased to 17,000,000. Pipe lines now under construction will increase the carrying capacity by about 200,000 barrels per day, and further lines with a capacity of 100,000 barrels per day have been projected. About 90 per cent. of the shipments are made from the port of Tampico, where admirable loading facilities exist. Although the number of tank ships for carrying the oil has been greatly increased during the past three years there is still an urgent need for more in order to permit increased production. The British-Mexican Petroleum Co. has been formed with a capital of £2,000,000 to establish a large fleet of tank steamers, acquiring storage facilities at the principal European ports for the bunkering of vessels with fuel oil. The new Government of Mexico has expressed its intention of dealing fairly with the foreign corporations engaged in the exploitation of Mexico's resources.

Lead Report.—Messrs. James Forster & Co. state that on Friday last values showed a rise of 7s. 6d. per ton on the week, at £34 17s. 6d. for October to £34 7s. 6d. for January; the quantity changing hands being about 4,000 tons. The feature of the week was the large buying for forward positions and the scarcity of "spot" lead. Consumers are working on very bare boards, and delay in arrival of Spanish ships caused the stoppage of two lead mills on the Thames. The September imports are the largest so far this year, but include 9,000 tons from Australia, 5,000 tons of which were in transit and re-exported; also a large proportion of the 9,000 tons was for Government account. The exports from Australia in September amount to 138 tons only; exports from Burma and Africa 1,500 tons, against 2,700 tons in August. Consequently November imports here should be very short.

The Board of Trade returns show a monthly average for the past 12 months of lead available for home trade of just over 6,000 tons, against requirements of probably 18,000 tons. The sheet, pipe, red and white lead trades alone are consuming well over 100,000 tons per annum. The gap between imports available and home consumption has been made up by Government stocks left over from the war, and the large quantity—far above expectation—of chemical scrap lead from plant dismantled by the Government.

The Coal Strike and Electricity Supply Undertakings.—LANCASHIRE.—Although the majority of Lancashire electricity undertakings have only from three weeks' to a month's supply of fuel on hand, it is anticipated that with careful economising and the restrictions that will be imposed, they will be able to keep up supplies for a longer period.

HALIFAX.—A considerable emergency stock of coal has been accumulated at the electricity works, and there is now sufficient to last for two months, perhaps longer. Local engineering works are run largely by Corporation electricity.

LIVERPOOL.—Steps were at once taken to effect economies in the reduction of the coal consumption. The deputy chairman of the Electric Power and Lighting Committee appealed to users of electric light to reduce consumption to the lowest possible point. A similar appeal was also regretfully made to power users, recognising the unemployment that might be caused by undue restriction. If no settlement is made this week immediate drastic restrictions in the tramway service will have to take place.

BIRMINGHAM.—The electric supply department has sufficient coal for at least five weeks. It will be necessary, however, to reduce the output to factories in order to maintain the supply to private consumers and the tramways. When this is accomplished, these supplies can be continued for a much longer period than five weeks. The Smethwick electric power station has a stock of coal sufficient for two months' consumption.

SHEFFIELD.—The electricity department can supply a restricted tramway service and lighting for many weeks.—*The Times.*

MANCHESTER ENGINEERING WORKS.—The engineering works of Sir W. C. Armstrong, Whitworth & Co., Ltd., at Openshaw, where 6,000 men are employed, is to suspend operations at the end of the week. No immediate effect is expected to be felt by the Metropolitan-Vickers Co., Ltd., Trafford Park. Messrs. Mather & Platt are in a position to keep going for at least seven or eight weeks.—*Daily Dispatch.*

Beginning this week it is proposed to cut off all electric power supply from the Trafford Park station each Thursday so long as the strike lasts, and suspend it until the following Monday.

BOLTON.—There is stated to be neither electricity nor gas available for public or private purposes in Bolton, Wath, or Thurnscope.

LEEDS.—The electricity department, like the gas department, is pretty well supplied with coal; it is generally understood that these departments have supplies to last several weeks with care. The only immediate precaution taken last week-end, on the beginning of the strike, was the reduction of public lighting by 50 per cent., but Leeds normally is exceptionally well lighted. If the strike continues, the general tramway service may be partially curtailed.

BRADFORD.—Stocks of coal at the electricity works are fairly good, accumulation having been possible during the summer, and in view of the strike threat for some time past. Some reduction of consumption will probably be necessary after a few days.

MIDDLESBROUGH.—Coal stocks are fairly large, and the consumption is automatically reduced by the fact that a good deal of local industry had to stop at once, involving immediate unemployment of 20,000 people. If economy is exercised there is little fear of a stoppage of supplies.

HULL.—Both the electricity and gas undertakings are well supplied with coal, and can maintain service for several weeks.

DONCASTER.—Supplies here are not sufficient to outlast a protracted strike, and it has been announced that if the strike continues the tramway service will be greatly curtailed, if not actually suspended, this week-end.

SCARBOROUGH.—Coal supplies here are good, and the electricity authorities can carry on for several weeks without material reduction of supplies.

ELLAND.—Two-thirds of the number of street lamps are to be left unlit, and the period of lighting is to be curtailed by one hour each night. The supply of coal at the electricity works will probably last a fortnight. Some of the textile firms have a fair stock of coal, and it may be necessary for the local authority to ask permission to use some of this so that the supply of current can be maintained. Local engineering firms are exceptionally busy.

The result of the ballot on the owners' offer to increase wages in proportion to output was 635,098 against, 181,428 for the offer, a majority of 453,670 against acceptance. The former ballot showed a majority in favour of a strike of 367,917. At the meeting of the miners' delegates in London to consider the result of the ballot, it was decided by 154 votes against 27 that the recommendation of the Executive Committee (to allow the strike notices to expire on Saturday, October 16th) should be adopted. The decision was communicated to the Prime Minister by letter, and was acknowledged by him with regret, but without any indication of weakening. The delegates afterwards dispersed.

Exports of coal were prohibited by the Government, and an order was issued by the Board of Trade urging all members of the public to economise coal, gas, and electricity to the utmost.

Three Emergency Orders have been issued by the Board of Trade. These are the Coal (Emergency) Order, 1920, the Gas and Coal Order, 1920, and the Lighting, Heating and Power Order, 1920. By the first the weekly consumption of coal in factories, workshops and other business premises is restricted to not more than 50 per cent. of the average weekly consumption during the four weeks ended October 16th. The Gas and Coal Order provides that the calorific value of gas shall not exceed 450 B.TH.U. per cubic foot. Under the Lighting, Heating and Power Order public lighting is to be reduced and skysigns and illuminated advertisements are to be extinguished; there must be no illumination of premises for advertising purposes or display, and the inside lights of shops must be for the actual conduct of trade.

On Monday and Tuesday the executive of the Transport Workers' Federation met to consider the situation, and on Wednesday a delegate conference of the National Union of Railwaymen was held. Commercial road transport workers on Saturday decided to insist on their demand for a minimum weekly wage, and some branches, including London, intend to put their strike notices into effect on Saturday, October 23rd.

Conduits and Fittings for Canada.—The Department of Overseas Trade informs us that H.M. Trade Commissioner, Toronto (Mr. F. W. Field), in a recent dispatch, intimates that he has been approached by Mr. F. A. Gaby, the chief engineer to the Hydro-Electric Power Commission of Ontario, who desires to investigate the suitability of English conduits and fittings for use in the Province of Ontario. He is particularly interested in obtaining samples of ¾-in. conduit, both enamelled and galvanised, in the following grades:—

1. Light gauge, brazed, not screwed.
2. Light gauge, seamless, not screwed.
3. Heavy gauge, seamless, screwed and socketed.

He would also like to see samples of as complete a line of fittings as possible including the following: Couplings, bends, elbows, crosses, inspection boxes, junction boxes, ceiling rose and switch boxes, ceiling rose and fittings, single-pole cut-outs, branching boxes, saddles, nipples, insulating nipples, base blocks and jumpers, running joints, pendant fittings, lampholder fittings, loose outlets.

It is suggested that United Kingdom manufacturers who are interested should communicate with Mr. Gaby, sending samples and literature descriptive of their products. In this connection His Majesty's Trade Commissioner states that the deciding factor in the decision of the Commission regarding the adoption of English material will probably be the interest shown by United Kingdom manufacturers, and as the Commission are purchasers of large quantities annually of these goods, it is in the best interests of United Kingdom manufacturers to give this inquiry their serious attention.

The Export Credit Scheme.—A letter has been sent to the President of the Board of Trade by the Federation of British Industries with regard to the export credit scheme instituted under the Board of Trade, pointing out certain features which, in its opinion, lead to the facilities which the scheme affords not being fully utilised.

In view of the paramount importance of every effort being made to foster export trade, the Federation remarks that the fundamental principle of the Treasury advancing 80 per cent. (for a period up to three years) of the cost price of the goods to be supplied leaves 20 per cent. to be advanced by the bankers of the manufacturing firm wishing to export; but bankers are exceedingly reluctant to advance this 20 per cent., even to old and favoured clients, when there are numbers of outlets for their funds in much shorter-dated securities at profitable rates.

It is suggested, therefore, in the first place, that the export credit scheme to be of any practical use should provide for advances to approved firms of 100 per cent., not 80 per cent. of the cost value.

It is the policy under the scheme to oblige the exporter to finance 20 per cent. of the net cost price of the goods that it is intended to export, but the exporter is forbidden to cover this risk by means of insurance. Why should he not only run the risk of making no profit, but also the further risk of losing 20 per cent. of the net value he puts into the work?

It may be argued that this obligation ensures the exporters only taking on sound business, inasmuch as business which is good enough for the Treasury to finance to the extent of 80 per cent. should be good enough for the profiting firm to finance to the extent of 20 per cent. But, practically, the exporter is not necessarily a financial expert, and provided that he can find such experts who by insurance will assume for him his 20 per cent. risk, the Government liability is reduced by the intended amount, and the exporter is still left with the legitimate risk of making no profit at all on his work. For these reasons the Federation strongly urges the Board of Trade to agree to the exporter being allowed, if he desires, to cover himself by insurance.

The export credit scheme was intended for private dealings, and its extension to dealings with the Governments of the countries to which it is applicable is in the nature of a concession. Nevertheless, the nature of security which was designed for the private trader is still rigidly applicable to a Government. This seems irrational, because certain kinds of security provided by the individual are not agreeable to Governments, which, on the other hand, are able to provide alternative forms of security outside the scope of the individual. The Federation urges, therefore, that in cases of transactions with Governments, great elasticity should be allowed, with regard to the nature of the collateral security which His Majesty's Government insists upon.

Finally, the Federation points out that the amount earmarked for this scheme was some twenty-six million pounds, and the amount drawn under it is understood to be a matter of some hundreds of thousands; this points conclusively to some inherent weakness in the scheme, which, in the opinion of the Federation, would be remedied by the adoption of its suggestions.

Manufacture of Washing Machines.—Mr. Sam Jackson, a well-known Shipley business man, has purchased the sole rights for the manufacture in England of the American Coffield electric washer. Recently Mr. Jackson made a tour of the States with the object of acquiring the patent rights of the best American machine. Keighley has been one of the foremost towns in the making of laundry machinery, and the industry has received a severe blow by the closing of Summerscales, Ltd., Phœnix Foundry, recently. Mr. Jackson is anxious that the manufacture of the newly-acquired American machine should be taken up by Keighley, and a move is on foot to bring about this end. Work will be found for at least 500 hands, and it is stated that an opening for the disposal of 10,000 machines is confidently assured.

LIGHTING AND POWER NOTES.

Aberdeen.—Year's Working.—The city's electricity accounts for the year ended July 31st last show a total revenue of £148,533, as compared with £107,996 in the previous year. Working expenses amounted to £95,687, as against £65,306, leaving a gross balance of £52,846 (£42,690). The net result, after payment of capital charges, was a surplus of £13,790, comparing favourably with the previous year's net profit of £7,537. The number of units sold rose from 16,368,054 to 18,800,949.

Aberystwyth.—Water Power.—It was reported at a recent meeting of the Town Council that a head of 100 ft. could be obtained at one point of the Rheidol River above Ponterwyd, and between Ponterwyd and the Rheidol Falls, a head of 200 ft. was available. The question of utilising this water power for the generation of electricity is being investigated.

Argentina.—Hydro-Electric Project.—A group of leading industrialists in the Department of Concepcion (Province of San Juan) is endeavouring to form a company with a share capital of $300,000 m/n. for the installation of an electric light and power station. The intention is to utilise a waterfall in the La Playa canal for the generation of electricity.—*Review of the River Plate.*

Basingstoke.—Electricity District.—The Town Council has asked the other interested authorities to join it in approaching the Commissioners with a view to obtaining an order constituting an area, including Aldershot and Basingstoke, as a separate electricity district.

Bury.—Extensions Approved.—The Town Council has received the final sanction of the Electricity Commissioners to the extension of the generating station at Chamber Hall.

Canada.—Toronto's Hydro-electric System.—The Annual Report of the Toronto Hydro-Electric Commissioners for the year ended December 31st, 1919, records a gross income of $2,504,758 and a working expenditure of $1,577,122, leaving a gross profit of $927,636. Interest, depreciation, sinking fund, &c., absorbed $923,484, and the net profit was $4,151. The number of KW.-hours sold fell from 230,413,561 to 180,609,938, chiefly due to the cessation of the manufacture of war *matériel*.

Cavan.—Street Lighting.—At a meeting of the Urban Council, details were given of the arrangements with the Electric Lighting Co. for the street lighting within the existing lighting area, and it was added that the company hoped to have the system extended later to outlying places near the town.

Continental.—Spain.—A concession has recently been granted for the establishment of a plant to utilise the water power of the River Puerto de la Ragua at Laroles (Province of Granada) in the generation of electrical energy for lighting and power purposes.

East Ham.—Year's Working.—The accounts of the electricity department for the year ended March 31st last, show a total revenue of £51,834, compared with £34,407 in the previous year. Working expenses amounted to £43,194, as against £31,679, leaving a gross profit of £8,640 (£2,728). The net financial result after payment of all capital charges was a deficit of £2,340, an improvement on last year's figure—£7,748.

Golborne.—Street Lighting.—The Urban District Council has asked Messrs. R. Evans & Co., Ltd., the Lancashire Electric Power Co., and the Lancashire United Co., for terms for the supply of electricity for street lighting.

Holmfirth (Yorks).—Extensions.—The District Council has decided to extend its electricity services on new routes at an estimated cost of about £11,000.

Ilkley.—Extensions.—In order to meet the increasing demand for electricity, the Urban Council has decided to extend the electricity works, at an estimated cost of £18,500. The present plant has a capacity of 200 KW. The new plant has been purchased from the Government Disposal Board, and the sanction of the Electricity Commissioners for the borrowing of £6,000 for this purchase has been received. The other items in the total cost of £18,500 include £11,000 for the additional buildings, £1,000 for plant, and £500 for an additional switchboard. The Council is making application to the Electricity Commissioners for sanction to borrow this further £12,500.—*Yorkshire Post.*

Keighley.—Losses on Contracts.—The borough electrical engineer says in his annual report that the undertaking has been badly hit by the fixed price agreements entered into before the war. No fewer than 70 industrial undertakings are affected by these contracts, and although in one or two instances increases have been agreed to, the extra revenue has not visibly affected the financial results of working. Increases in coal prices are the only changes which can vary the agreements.

Kelso.—Lighting Scheme Abandoned.—The Gas Co. having intimated that the lowest estimate for an electric light installation for the town, with overhead mains, was £11,250, and the highest £30,000, the Town Council has decided to take no steps in the matter.

King's Lynn.—Extensions.—The Council has adopted a report of the Electricity Committee recommending the following extensions and additions:—2,150 yd. of '05, three-core H.T. cable, £2,687; one 150-KW. rotary converter, £1,300; one 400-K.V.A. transformer and switchgear, £1,000; and a new building, £500.

Kirkcaldy.—Sale of Station.—In connection with the negotiations between Kirkcaldy Corporation and Fife Power Co. for the transfer of the former's electricity undertaking, the town clerk has been instructed to write the Power Co. and inquire whether it will be willing to purchase the undertaking immediately, and without option, as previously suggested. If an immediate purchase were made, entry would be at May 15th, 1921.

Lepton (near Huddersfield).—House Lighting.—Representations are to be made to the Housing Commissioner by the Urban District Council urging him to agree to the cost of the installation of electric light in the new houses.

Subject to Huddersfield Corporation agreeing to pay all expenses to which the Council may be put in supporting the former's application for an order authorising it to supply electricity for any public or private purpose within the area of the Council, the Urban District Council has given its consent to the proposal.

Leeds.—Transformer Breakdown.—Whilst a slight thunderstorm was in progress, on the afternoon of October 15th, a breakdown of a transformer occurred in one of the sub-stations at the generating station in Whitehall Road, causing an explosion in the switching equipment. The plant was brought to a standstill and the city deprived of power for a time. There was a good deal of smoke as a result of the explosion, rendering repair work difficult, but the matter was put right in time to renew supply to the city generally in three-quarters-of-an-hour, though one or two isolated parts of the city were without electricity for about two hours. The damage to plant was not great, and there was no personal injury.

London.—Cable Explosion.—On October 12th the fusing of a cable in the Uxbridge Road caused a loud explosion, tearing up several yards of pavement and starting a fire. With some difficulty the fire was extinguished. The cable was the property of the Metropolitan Electric Light Co.

Stoke Newington.—The Council is recommended to apply for sanction to a loan of £10,000 for the extension of mains and services.

Marsden (near Huddersfield). — Electric Light Scheme.—At a meeting of the District Council, last week, Mr. G. H. Whiteley, in accordance with a resolution at a previous meeting, outlined a scheme for electricity supply for the district, and the Council decided to call a special meeting to consider the proposal in detail. Mr. Whiteley suggested the acquisition of a site at a mill at Warehouse Hill—he believed the parties concerned might hand the mill over without need to purchase—where there was a good water supply for generation of electricity. The approximate cost of his scheme, including plant and cables, would be £6,560. He calculated the working costs to be £1,248, and the income from 200 consumers, meter rents and 125 public street lights, £2,511, leaving a profit of £1,263.

Navan.—Lighting Scheme.—At a public meeting to discuss the proposed public electric lighting scheme, it was stated that the scheme would cost £10,000, and that the first year's results would about cover the expenses.

Richmond (Surrey).—Electricity and Housing.—Apparently there is some difficulty about lighting the new houses being built under the local housing scheme, as the Electricity Supply Co. is not prepared to lay mains in the roads, so the new dwellings are to be electrically lighted in those roads where mains already exist, while in other cases gas is to be installed.

Stratford-on-Avon.—Electricity Undertaking.—At a meeting of the Town Council on October 12th, Alderman Winter said his Committee could not recommend the Council to take over the electricity undertaking for £10,000. A sum of £30,000 would require to be expended on renewals, and then the town would be faced with a deficit of £778 on a year's working. The company would be in a better position to treat with the Electricity Commissioners than the Corporation.—*Birmingham Post.*

Truro.—Electric Lighting Scheme Required.—The local Mercantile Association is urging the City Council to consider the possibilities of an electric lighting scheme for the city.

Walsall.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £119,500 for new plant and other works in connection with the electricity undertaking, on the understanding that the Corporation is willing, when necessary, to link up with the Wolverhampton Corporation or the Midland Electric Corporation, or both, and to assist in the formulation of a scheme for supplying any new district with electricity determined on by the Commissioners in the North Midland district.

The Corporation has confirmed a proposal of the Electricity Committee that application be made to the Electricity Commissioners for sanction to borrow £10,000 for house service cables.

Warwick.—Minimum Charge.—The local Chamber of Trade has passed a resolution urging the abolition of the fixed minimum charge, allowing the consumer to pay only for electricity actually used.

Whitehaven.—Loan.—The Town Council has applied for a loan of £12,000 for the provision of a steam generating set.

TRAMWAY AND RAILWAY NOTES.

Bradford. — Revenue from Higher Fares. — The result of a complete week's working under the advanced fares (October 3rd to 9th) has shown an increase in revenue of £3,176 compared with the corresponding week of last year. During the current working year the receipts have shown an average weekly increase of £900 over last year's figures.

Burnley.—Mishap.—A tramcar mishap occurred in Manchester Road, Burnley, on October 14th. A car commenced to run backward down the steep gradient of Halstead Street. A passenger ran to the brake, and tried to stop the car. Eventually it was brought to a standstill by the driver. It was then found that the brakes were broken. In attempting to alight, a passenger fell to the ground and sustained concussion.

Continental.—Sweden.—The Swedish Railway Administration has requested the Government to ask the Riksdag to provide for 1922 the sum of Kr. 26 mill. for the electrification of the Stockholm-Gotenburg line. The total cost of the scheme is estimated at Kr. 75 mill.—*Economic Review.*

Darwen.—New Cars.—It is stated that the three new cars on order will not have covered tops, for the reason that they could not be used on the Blackburn route, as the bridges in Blackburn are not high enough to permit covered cars to run under them.

East Ham.—Year's Working.—The total revenue accruing to the Tramways Department for the year ended March 31st last was £95,235, compared with £84,848 in 1918-19. Working costs totalled £104,386, against £85,691, leaving a gross deficit of £9,151 (£843), which was increased by payment of capital charges to £21,355 (£11,174).

Japan.—Railway Electrification.—Extensions of the electric railways running out of Tokio, which will link many important centres with the capital, are now planned by the Railway Department. A decision has already been reached to run an electric line from Ryogoku to Chiba, and from Kichijeji to Hachioji. Another extension under consideration is that of the present Tokio-Yokohama electric line to Odawara and Yokosuka. A new electric line out of Syeno Station to Takasaki is also planned. The authorities expect to have the five-mile section between Hachioji and Kokubunji in operation before the end of the year. The Ryogoku-Chiba line will be attended to after Manseibashi and Ryogoku have been connected.—*Chamber of Commerce Journal* (Yokohama).

London.—New Tramway.—The construction of the tramway from West India Docks to Terrace Road, Hackney, *viâ* West India Dock Road, Burdett Road, Grove Road, Lauriston Road, and Well Street, has been commenced by the Consolidated Construction Co., Ltd., on behalf of the London County Council. The system to be adopted is that of the overhead electric trolley. The tramway will link up directly the boroughs of Poplar and Hackney.—*Daily Telegraph.*

Increased Fares Results.—In a statement issued from Electric Railway House it is stated :—"For the second week during which the increased fares have been in operation—the week ended October 9th—the number of passengers carried on the Underground railways and omnibuses together, exclusive of railway season-ticket holders, was higher by 350,000 than the number carried during the preceding week. Taking the railways and omnibuses separately, the former carried 50,000 fewer passengers, while the latter carried 400,000 more."

Instructions to Employés.—In a document addressed to men of the Metropolitan Electric Tramways, the Union of Vehicle Workers says :—

"In view of the large amount of unemployment prevailing and of the recent dismissals that have taken place on the company's system, the following instructions are issued, which every member is expected to adhere to :—

"To abstain from working 'rest days' during winter months and overloading to be strictly limited to that allowed by the police (only 11 allowed to stand in any car). This has not been rigorously observed recently because of great passenger traffic."—*Daily Chronicle.*

"Tube" Accident.—In the afternoon of October 14th, a train on the District Railway ran into the buffers at Wimbledon station and mounted the platform. None of the passengers received injury, but a women was killed and four others were injured while waiting for a train.

At the inquest subsequently held on the body of Mrs. Judith McLelland, the lady who was killed, the motorman stated that upon entering the station he shut off power, and applied the brakes as usual, approaching the buffers at the usual speed. He found the brakes were not acting, and put on the emergency brake, which, however, also failed to hold the train. Witness stated that he had held the position of driver for six months. An inspector stated that even at the speed of two miles an hour, the train would climb the buffers on account of its weight; there was a slight incline towards the platform, and the buffers were unsuitable. The jury returned a verdict of "Accidental death," adding that the train appeared to have been travelling a little too fast, and the motorman had committed a slight error of judgment; it was thought that more suitable buffers should be erected.

St. Pancras.—The Council has decided to install a motor-generator set at the Bangor Wharf depôt, at an estimated cost of £350, for the purpose of charging the batteries of two electric dust-vans.

Tramway Employés.—New Wages Demand.—The National Joint Industrial Council of the Tramways Industry recently held a meeting at the Ministry of Labour to consider the question of standardisation of wages. Mr. H. J. Squires, chairman of the London County Council Tramways Committee, presided. The employés' representatives put forward a demand for a further all-round increase of 12s. per week, on which the employers declined to proceed with the question of standardisation. The employés' representatives then "requisitioned" a meeting at the Ministry of Labour for October 26th to consider the wages demand. —*The Times.*

Wigan.—Female Employés. — Owing to the large number of applications by men for posts at present held by women, the Corporation has decided to replace the female conductors and car-cleaners as soon as convenient by males.

TELEGRAPH AND TELEPHONE NOTES.

Baltic States.—Telegraphic Codes.—In reply to a recent inquiry respecting the use of commercial codes in telegrams between the United Kingdom and the Baltic States, the Postmaster-General informed the Department of Overseas Trade that as regards Latvia, the only conditions imposed are those of the local authorities in Latvia. At this end, the position is that all telegrams must be in plain language, but it is understood the General Post Office will accept codes at the sender's risk, as the local authorities in Latvia may, or may not, accept them. As regards Esthonia code telegrams are now definitely accepted if they are addressed to well-known firms, on condition that, when and if called for, the codes must be produced for the Esthonian Government.—*Board of Trade Journal.*

Telegrams by Aeroplane.—During the recent strike of the Dutch postal employés and telegraphists, urgent cable messages for the U.S.A. and other countries were brought from Amsterdam to London by the Handley-Page Air Mail Service, and transmitted by ordinary telegraph cable from London.

New Baltic Cable.—The British cable-steamer *Faraday* has arrived at Visby, on the Island of Gotland, Sweden, for the purpose of laying a telephone cable between Visby and Stockholm.—*Reuter's Trade Service* (Stockholm).

New Telephone Exchange.—At 2.30 p.m. on the 16th inst., the new Liverpool "Central" telephone exchange was put into commission to replace an old and inadequate exchange of the same name. The "Central" is the junction centre of the city, and the introduction of new and improved apparatus has necessitated the alteration of the telephone numbers on a fairly large scale.

Switzerland.—League of Nations' Wireless Installation.—It is understood that the League of Nations, whose secretariat is due to arrive at Geneva from London at the end of this month, proposes to have wireless apparatus installed at its headquarters capable of communicating over a distance of 750 miles.

Underground Telephone Cable.—To relieve the congestion of the overhead telephone wires an underground cable is being laid between Glasgow and Greenock.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review, *in which the "Official Notice" appeared.)*

OPEN.

Australia.—January 19th, 1921. Victorian Railways Department. Supply, delivery, and erection and testing, or, alternatively, supply and delivery of electric furnace and equipment, and/or, alternatively, for supply and delivery of equipment, and drawings for electric furnace. Particulars from the Agent-General for Victoria, London, S.W.—*Tenders.*

Brisbane.—November 23rd. P.M.G.'s Department. Telephones and telephone switchboard parts. (October 8th.)

Western Australia.—December 28th. Postmaster-General's Department. Telegraph and telephone instruments and parts. (Schedule 689).

Belgium.—October 26th. The Société Nationale de Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Underground armoured cables for feeding the Namur-Citadelle-La Plante railway. Electrical Department (Services Electriques) of the company, at 48, Rue Monteyer, Brussels.

Tenders are being invited by the municipal authorities of Wevelghem for the establishment and equipment of two new transformer cabins in connection with the electricity supply in the town. The specification can be seen either at the Secretariat Communale, Wevelghem, or at the offices of M. Goffin, Ingenieur-Conseil, 113, Avenue Albert, Brussels.

October 30th.—The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Supply and fixing of a quantity of telephone cables and accessories in the Antwerp district. The specification (cahier des charges special No. 544) can be obtained from above address at a cost of 7 fr. 90 c.

November 3rd. Municipal authorities of Hognoul (Province of Liége). Concession for the supply of electrical energy for lighting and power purposes in the town.

November 4th. Municipal authorities of Schaerbeek. Supply of 1,675 electricity meters (single-phase and three-phase). Copies of the specification may be obtained from the Service de l'Electricité, Hotel Communale, Schaerbeek.

November 9th. Municipal authorities of Antwerp. Electrical plant. Specification from the Hotel de Ville, Antwerp.

Costa Rica.—The Government of the Republic is inviting tenders for the concession for the construction and working during a period of 50 years of an electric tramway between the towns of Alajuela and Grecia. Particulars can be obtained from the Consul-General of Costa Rica, M. Camille Marchant, 10, Avenue Hamoir, Brussels, Belgium.

Doncaster.—November 2nd. Electricity Department. One 750-kw. rotary converter and L.T. switchgear. (See this issue.)

France.—October 26th. French State Railway authorities (Service Electrique), 43, Rue de Rome, Paris. Supply and laying of two high-tension three-phase cables between the sub-stations of La Garenne, Chatou and St. Germain.

November 19th. French State Railway authorities, Rue de Rome, Paris. Supply and installation of the necessary electrical material for the Ouest-Ceinture sub-station. Particulars may be obtained from the Service Electrique, 43, Rue de Rome, Paris.

November 26th. French State Railway Authorities, Paris. Supply and erection of two electrically-operated travelling cranes at the La Garenne electrical repair shops. Particulars may be obtained from the Service Electrique, 88, Rue de Rome, Paris.

Italy.—The Department of Overseas Trade has received an inquiry from Rome for electric gantry cranes, to lift 1·5 tons at a radius of 12 m. Particulars from the D. O. T., where a sketch can be seen.

Manchester.—October 27th. Electricity Committee. Complete heating installation for the workshop and stores at the Barton power station. Mr. S. L. Pearce, Chief Engineer and Manager, Dickinson Street.

November 8th. Electricity Committee. Supply and erection of high and low pressure steam, feed, &c., pipework—including alterations to existing pipework, &c. (October 15th.)

November 22nd. Electricity Department. Motor-generators, battery boosters and switchgear. (See this issue.)

Turton.—November 10th. Urban District Council Electricity Committee. Overhead lines and underground cables. (October 15th.)

West Hartlepool.—October 26th. Electricity Department. One 1,000-kw. rotary converter and switchgear. (October 8th.)

CLOSED.

Australia.—Sydney City Council. Electric Lighting Committee. Accepted :—

Maximum-demand indicators, £1,891.—W. G. Watson & Co., Ltd.
Spare parts for the 8,000-kw. turbo-alternator, £2,000.—Met.-Vickers Electrical Co., Ltd.

Melbourne.—City Council. Electric Supply Committee. Accepted :—

Meters.—(a) £1,641.—British General Electric Co., Ltd. (c) £560.—W. G. Watson & Co., Ltd. (d) £334.—W. G. Watson & Co., Ltd. (e) £249.—Warburton, Frank (Pty.), Ltd.
Split-conductor three-core cables, £14,569; 500 yd. v.i.r. cable, £219.—

P.M.G.'s Department, N.S.W. :—

W. T. Henley's Telegraph Works.
Telephone exchange equipment, £6,246.—Automatic Telephones (Aust.), Ltd.—*Tenders.*

Middlesbrough.—
Electric lighting equipment of the 160 houses in connection with the housing scheme. Mr. G. Morrison.

Sunderland.—Town Council. Accepted :—

B. I. & Helsby Cables Co.—880 yd. service cable; 440 yd. ·1 cable; insulating tape.
Time Recorders (Leeds), Ltd.—Bunty time recorder, with fittings.
Callender's Cable Co., Ltd.—24 tee boxes.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 22nd. At the Institution, Storey's Gate, S.W. At 6 p.m. Address by the President.

Junior Institution of Engineers.—Friday, October 22nd. At 39 Victoria Street, S.W. At 8 p.m. Paper on "Impulse Turbines," by Mr. A. H. Fitt.

Manchester Association of Engineers.—Saturday, October 23rd. At the Memorial Hall, Albert Square, Manchester. At 7 p.m. Paper on "Vibration, including that of Crank Shafts, Fly Wheels and Alternating-current Generators," by Mr. J. Frith.

Birmingham and District Electric Club.—Saturday, October 23rd. At the Grand Hotel, Colmore Row. At 6.30 p.m. Annual ladies' night.

Institute of Industrial Administration.—Saturday, October 23rd. At the Central Hall, Westminster. At 8 p.m. Address on "The Industrial Question," by Viscount Haldane.

Faraday Society and Physical Society of London.—Joint meeting, Monday, October 25th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 2.30 p.m. General discussion on "The Physics and Chemistry of Colloids and their bearing on Industrial Questions."

Chemical Society.—Thursday, October 28th. At the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W. 1. At 8 p.m. Fischer Memorial Lecture, by Dr. M. O. Forster, F.R.S.

Chelmsford Engineering Society.—Thursday, October 28th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Gauges and their Manufacture," by Mr. E. A. N. Pochin.

Northampton Past-Day Students' Associatio—Friday, October 29t At the Northampton Institute, Clerkenwell. At 7 p.m. Smokin concert.

NOTES.

Summer Time.—The Home Secretary gives notice that summer time will cease, and normal G.M.T. be restored, at 3 a.m. (summer time) on the morning of Monday next, October 25th, when the clock will be put back to 2 a.m. Clocks should, therefore, be put back during the night of Sunday-Monday next, October 24th-25th.

Legal.—P.M.G. *v.* Blackpool and Fleetwood Tramroad Co., Ltd.—This case came before the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Atkin and Younger, on October 18th, upon the appeal of the defendant company from a judgment of a Divisional Court, reversing a judgment of the judge sitting at the Blackpool County Court in an action brought by the Postmaster-General to recover £16 18s., the agreed expenses incurred in making certain alterations or repairs to telegraph lines which were alleged to have been injuriously affected by the working of the defendant company's electric tramway.

A report of the case appeared in the Electrical Review for December 19th, 1919.

At the conclusion of the arguments of counsel, their Lordships dismissed the appeal, holding upon the facts and the course adopted in the County Court, that it was impossible to interfere with the decision of the Divisional Court.

Appointments Vacant.—Foreman, $325 per month, for the Government of the Federated Malay States; switchboard attendant (94s. 6d.) for the Derby Corporation Electricity Department; engineering draughtsman (£427), for the Hammersmith Borough Council Electricity Department; repairs superintendent (£300 + £180), for the L.C.C. Greenwich generating station; electrical engineer (7,500 Rs. per annum), for the Government of Mauritius; assistant engineer operator ($360 per month + 20 per cent.), for the Brunei Wireless Telegraph Stations of the Government of the Straits Settlements; jointer, for the Wrexham Corporation Electricity Department; plumber-jointer, for the Walsall Corporation Electricity Works. See our advertisement pages to-day.

Salving War Wrecks.—Mr. A. H. Salinger, of New York, has perfected a new device which is being tested, and which he asserts will be effective in salving valuable ships and cargoes which were sunk during the European war. The device has an electric control operated from the surface. This directs its passage to the floor of the sea and under the ship clearing the keel by 8 ft., and emerging on the opposite side of the vessel, where it is attached to a cable. When enough cables are placed under the ship to attach to pontoons of a special collapsible type, air is pumped into the pontoons and the ship is raised to the surface. The inventor asserts that his method is much less costly than those at present employed, and that the time required to complete the task is greatly reduced.—*Reuter's Trade Service* (New York).

Distribution Mains in Italy.—The following statistics are abstracted from an article by Sr. Reboa in *L'Elettrotecnica*:—

Electric Networks.

Kind of conductor.	Length of lines (kilometres).	Weight o copper (tons).	Kilograms of copper per linear metre of conductors.
H.P. overhead lines ...	27,600	34,000	1·23
L.P. " " ...	21,000	11,000	0·525
H.P. cables	5,800	3,900	0·675
L.P. "	5,600	6,100	1·915
Totals ...	60,000	55,000	—

Educational.—The resolution passed by the shareholders of Messrs. Brunner, Mond & Co., authorising the directors to distribute to universities or other scientific institutions the sum of £100,000 for the furtherance of scientific education and research, has been challenged by Mr. W. W. Evans, a shareholder, who has brought an action for an injunction to restrain the company from carrying out the proposal. The trial of the action is pending.

London Lectures Postponed.—The course of lectures on "Experimental Studies in Vegetable Physiology and Vegetable Electricity," which was to have been given during the present term at the London University, South Kensington, by Prof. A. D. Waller, has been postponed till next session, owing to the fact that Prof. Waller's lecture room is still in use by the administrative staff of the University. During the war a portion of the buildings was commandeered by the Government, and it became necessary for the University authorities to requisition the lecture room for work connected with the administrative offices.—*The Times.*

London University.—The L.C.C. Education Committee at a special meeting on the 18th inst. decided that subject to arrangements being made between the Government and the Council of King's College, and in the event of the University of London accepting the Bloomsbury site, and provided that adequate grants are made by the Government for building administrative quarters, the Council is prepared to consider an application for a building grant. It was stipulated that the Council's contribution should not exceed one-third of that made by the Government, to a total not exceeding £1,000,000. The Senate of the University was to consider the matter this week.

I.M.E.A. Meeting.—A special general meeting of the Incorporated Municipal Electrical Association was held on October 15th, when the question of the future position in connection with the National Joint Industrial Council and District Councils of the electricity supply industry was considered.

L.E.E. Re-union.—The London Electrical Engineers' Old Comrades' Association is holding a re-union concert at the Bridge House Hotel, London Bridge, on November 20th. Admission will be by membership card obtainable from the Hon. Sec., 108, Heathwood Gardens, Charlton, S.E. 7.

Fatalities.—At Deans Oil Works, West Calder, on October 14th, Alexander Ellis, a miner, lost his life under peculiar circumstances. A live electric wire from the power station had, in some way, got into contact with a door handle, and when Ellis turned the handle, he received a shock, and died immediately.

French "Leader" Cables.—Admiral Fournier, on October 11th, addressed the Academy of Sciences, in Paris, on the subject of "leader" cables for guiding ships. It is reported that the French Minister of Marine has decided on the installation of the system in all French ports, and there is some talk of laying a cable across the English Channel.

Bethlem Hospital X-Ray Department.—Founded in 1247 by a leading London citizen, the Bethlem Royal Hospital for the treatment of sufferers from mental diseases takes honourable rank. In 1916 a generous donor installed a complete kinematograph apparatus for the amusement of patients and staff. The work is now taken a step further by the generous gift of the president of the hospital, Sir Charles Cheers Wakefield, C.B.E., who is presenting a complete X-ray installation to the hospital, which is to be inaugurated to-day by the Lord Mayor.

Barnsley Apprenticeship Scheme.—The Town Council has approved a scheme, submitted by the borough electrical engineer, for the employment of apprentices at the electricity works at the age of 17 years and upwards, the period of apprenticeship to be three years at the following scale:—First year, 25s. per week; second year, 30s. per week; third year, 35s. per week. It was also decided that such apprentices should be afforded every facility for attending classes at the Technical School.

New York "Leader" Cable.—As we foreshadowed some time back, the U.S. Nav.l authorities, on the 6th inst., carried out successful demonstrations of how a ship may be guided into harbour safely, in spite of the densest fog, by means of a submerged "leader" cable carrying an alternating current. The experiment took place in the Lower Harbour at New York, and Com. Norton "picked up" the cable down stream; by listening in he steered the U.S.S. *Semmes* to port or starboard, according to the volume of sound indicating his position. The receivers consisted of two coils hung just above the water-line on either side of the destroyer in conjunction with amplifiers at the steering position.

Electricity and Housing.—We have from time to time referred to what is being done in various parts of the country with regard to the application of electricity to housing schemes, and the excellent idea of the E.D.A. in attempting to persuade electricity supply authorities to provide a few "all or semi-electric" houses in every district, with the object of obtaining actual data, will doubtless give fruitful results that will be of much value. In this connection, the Newcastle-on-Tyne Electricity Supply Co., Ltd., has been working for a long time on a housing scheme in the Billingham district, and at the present time, when so many housing schemes are under consideration, it is thought that a concrete example of what is actually being done in one district will be of wide interest. We hope to return to the subject at an early date; for the present it will suffice to draw attention to a booklet which is about to be issued by the above company in the hope that the particulars therein given will prove useful to housing authorities and others interested, who are invited to visit the houses described, and see for themselves what is being done. At present only 73 houses, of four different types, are being built, and they are intended for the working classes. The booklet first deals with the advantages that are derived from the use of electricity in houses, and proceeds by the aid of plans and illustrations to describe the lighting, heating, and cooking apparatus installed in the various rooms. It may be mentioned that in the bathroom and scullery hot and cold water systems are installed, and the latter room also contains an electrically-heated clothes boiler. An electric cooker and electric fires are provided. Finally, details and figures are given with regard to current consumption, and tests of electric cooking for six persons in a house.

Electrical Treatment for Tooth Diseases.—With further reference to our note under the above heading in our October 8th issue, it is interesting to learn that as early as 1911 the Cox-Cavendish Electrical Co., Ltd., placed on the market a special apparatus designed for the treatment of various dental diseases by means of electricity, the treatment being known as "Ionic Medication," and carried out through the agency of a galvanic current. A large number of outfits has been supplied since that date, and in 1918 an interesting booklet on the subject was published by Mr. E. H. Willis.

Long Span in Transmission Line. — The *Electrical Review* of Chicago, quoting a paper read before the American Institute of Electrical Engineers, describes how the problem was solved of carrying a high-voltage transmission line between two mountain tops by the Knoxville (Tennessee) Power Co. The length of this span is 5,010 ft., and a total of 83 steel and aluminium wires were stranded together to form the cable. This cable, which has a diameter of 1.175 in. and a weight of 2.032 lb. per ft., has an elastic limit of 65,000 lb. and an ultimate strength of 82,000 lb. Allowing an increase in weight of 1.025 lb. per ft. due to ice, and assuming a horizontal wind pressure of 1.085 lb. per ft. of length, the total resultant loaded weight per foot amounts to 3.25 lb. The temperature at the time of stringing the cable was about 80 deg. F., and the three lower spans were installed with a sag of 237 ft. below the lower support, the difference in elevation of supports being 208.5 ft. The upper cable was suspended with a sag of 116 ft. below the lower support, the tension in this cable having a value of about 10 tons. The insulators used on this long span are rated at 150,000 volts, and are of the oil-filled, porcelain-covered, strain type. The hickory wood used in their construction was carefully selected and tested before being finally passed.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Western Centre.—The ninth annual meeting of the Western Centre was held at Cardiff on Monday evening last, the Chairman (Mr. Arthur Ellis) presiding over a good muster of members and visitors. The annual statement of accounts was presented by the Treasurer (Mr. A. J. Newman). This statement showed an adverse balance on the session's working, and Mr. Newman emphasised the necessity of strictest economy during the coming session if the future activities of the Centre were not to be seriously curtailed. The scrutineers of the ballot reported that the following had been elected to the vacancies on the committee:—Messrs. C. G. Morley-New, B. K. Ashton, W. Nairn, T. Hood, and Major Ivor David, with Mr. A. J. Newman as chairman and Messrs. A. C. McWhirter and F. Tremain as first and second vice-chairmen respectively. After the transaction of routine business an interesting presentation was made to Messrs. C. T. Allan and A. J. Ostler, the joint hon. secretaries of the Centre. The presentations took the form of a split-second stop watch for Mr. Allan, and rose bowl and fruit dishes for Mrs. Allan, and a soup tureen convertible to entrée dishes and a silver cigarette case for Mr. and Mrs. Ostler. The Chairman, in making the presentations, asked the recipients to accept the gifts as a small token of the appreciation which was felt by those who took part in the summer meeting of the Institution. That function had been an unqualified success, and it was in no small measure due to the untiring efforts of Mr. Allan and Mr. Ostler. After Mr. Allan and Mr. Ostler had suitably responded, a short address on "Technical Education" was given by Principal Cole, of the Cardiff Technical College, and this was followed by an address by Sir William Noble, chief engineer to the Post Office, on "Post Office Telegraphs and Telephones." Sir William gave a *résumé* of the work accomplished by the Government in these departments, and dealt with the plans regarding Cardiff. Progress was being held up chiefly on account of the shortage of material. He considered that Great Britain still maintained her supremacy in telegraphy and telephony, and that the service given whilst far from perfection compared favourably with that of any other nation. Hearty votes of thanks were accorded both Principal Cole and Sir William Noble for their addresses.

Chelmsford Engineering Society.—The first meeting of the new session was held on October 13th, when Mr. T. E. Dann gave his presidential address. The speaker pointed out that a very comprehensive programme had been arranged, and urged members to take a wide view of the subjects dealt with, and not confine themselves strictly to the technical side. Mr. A. Haskins, M.B.E., in moving a vote of thanks to the President, extended an invitation to the Society to visit Messrs. Hoffmann's works, and Mr. A. Eddington invited the Society to Messrs. Marconi's at some future date. The membership now stands at 90.

Faraday Society and Physical Society of London.—A general discussion on "The Physics and Chemistry of Colloids and their Bearing on Industrial Questions" is to be held at the Institution of Mechanical Engineers, Storey's Gate, S.W.1, on October 25th. Sir Robert Hadfield, Bart., F.R.S., will take the chair at 2.30 p.m., and Prof. Sir William Bragg, K.B.E., F.R.S., will preside over the discussion. Among the many papers to be presented are "The Origin of the Charge of a Colloidal Particle and its Neutralisation by Electrolytes," by Mr. J. W. Mukherjee, M.Sc., and "Some Practical Applications of Electro-endosmose and Cataphoresis," by Dr. W. R. Ormandy, F.I.C.

Association of Mining Electrical Engineers.—The Yorkshire branch of the Association held its first meeting of the session at Wakefield, on October 9th, when Mr. F. W. Harbottle delivered his presidential address. He took as his subject "The Efficient and Safe Working of Electrical Apparatus in a Mine." Colliery electricians, he feared, were apt to be a little lax with regard to the periodical examination of the plant under their care, and he strongly advised that periodically all electrical apparatus should be taken out of the pit and thoroughly overhauled. A coal cutter or conveyor working in adverse conditions should be brought out every six months; motors working under better conditions could remain at work undisturbed for, perhaps, three years, while static apparatus such as transformers and switches could remain in the pit for five years. He also urged the changing of oil used in transformers and switches at least every two years. The deteriorating effects on insulation of a dry, dusty atmosphere or high temperature were also dealt with. To prevent motors running at excessive speed, due to a negative load, he suggested the use of an over-speed governor or a clutch. Protection against overload was dealt with, and the need for systematic supervision emphasised.

The members then discussed in detail the new rules regulating the use of electricity in mines.

An Ayrshire sub-branch of the Association has been formed, and the opening meeting was held at Kilmarnock on October 16th. Mr. Archibald Smellie, New Cumnock, is president.

The West of Scotland branch of the Association opened the session on October 16th, when Mr. Frank Anslow, Glasgow, the president, gave an address on the electrification of collieries and a new form of power transmission.

The South African Municipal Electrical Engineers' Annual Congress.—The fourth annual convention of the Association of Municipal Electrical Engineers was held in September at Pretoria. Mr. B. Sankey (Johannesburg) presided over a large attendance, and in the course of his retiring address, said that one of the unfortunate features of the last year's history of the Association had been the loss of a large number of its most responsible and valued members who had retired from municipal life, tempted in most cases by the sweets of commercial life. On the one hand, wage earners were being paid sums which rested upon no basis of individual skill or output, but were simply the result of collective bargaining, and they were often too high. On the other hand, the salaried official, who until recently had disdained to combine, was often being remunerated at a rate far below the figure which represented his real value. That, as events had shown in their own Association, was most evident in Government and municipal departments, where the brain worker had less opportunity of controlling his gains than in commercial life. Of the two situations the underpayment of the brain worker was likely to do the country more harm, though while politics could intrude into these matters in the way they did at present, it was difficult to see how the situation was to be altered without a good deal of trouble. A joint committee of the South African Institute of Electrical Engineers and of their Association was, however, meeting to endeavour to improve the salaries and working conditions of municipal electrical engineers. Meantime, he had undertaken on behalf of their Association to collect and tabulate statistics of salaries and working conditions of municipal electrical engineers at the present time. Some of the working conditions in the small towns read more like the days of slavery, and one could hardly realise the spirit of heartless indifference which apparently permeated some small councils. If the Association could bring the attention of the Government to the necessity of the employment of competent engineers to have charge of electrical undertakings, and of engaging only consulting engineers of proved ability and long experience in their particular branch of the profession, it would have performed good service to its members and the public alike.

Mr. T. C. Wolley Dod (Pretoria) was elected president of the Association, and in his address to the convention, dealt with municipal electric undertakings, including the generation, distribution, and utilisation of electric energy. Whether the concerns they controlled were large or small, there was one feature common to them all—expansion. The early history of electricity supply in South Africa followed very much the same lines as in Great Britain. Initiated by private enterprise in the principal towns, it was soon taken up by local authorities, and in urban areas was now practically exclusively in the hands of the municipalities. Municipal control would continue to exist for many years to come, at any rate, in the smaller municipalities, but the tendency of the future must be towards the super-power station under more catholic control. The proposed electrification of railways in certain districts would give rise to the establishment of power stations, either under the joint control of local authorities and the railways, or far more probably controlled by some body independent of either. South Africa was not a country where hydro-electric stations were likely to be of any importance, and it was to the coal-fired steam stations they must look for the future.

Mr. Dod reviewed the various provincial ordinances and municipal by-laws dealing with the supply of electricity, and said there was nothing in any of them to prevent the municipalities of the Union adopting a uniform code of by-laws and regulations, provided they were accepted by the various administrators. More particularly would it be advantageous to adopt a uniform code of wiring regulations. He advocated

powers for municipalities to license electricians. It was desirable that such licences should be compulsory. Johannesburg already issued such licences, and Pretoria was about to do so.—*S.A. Mining and Engineering Journal.*

"Northampton" Past-day Students' Association.—This Society, of which every past-day student of the "Northampton" Institute, Clerkenwell, is a member, was in comparative abeyance during the war. It has been revived under the guidance of a list of keen officers and committee, and it is hoped that as many members as possible will endeavour to attend the smoking concert to be held at the Northampton Institute on Friday, October 29th, at 7 o'clock. A good programme has been arranged, and a pleasant evening is anticipated; the reunions, it is expected, will be the happiest features: Joint meeting with N.I.E.S.; N.I. students' dance (ladies' night); annual dinner; annual general meeting. The secretary, Mr. W. S. Salter, of 11, Delcourt Mansions, Rosendale Road, Dulwich, S.E. 21, will be pleased to hear from any member who has not received his membership card.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Barnes U.D.C. has decided that as from October 1st the electrical engineer shall be granted the full Civil Service war bonus on such basis salary as will increase the gross salary paid to him by £100.

After the monthly meeting of district engineers of the Newcastle-upon-Tyne Electric Supply Co., Ltd., the presentation of a suitably inscribed gold watch was made to Mr. M. F. SHEEDY upon his transferring to the company's power department. Mr. Sheedy has been in the operating department for eight years, and has held the position of superintendent engineer of the Southern area. Mr. W. R. Rogers, district engineer, Gateshead, made the presentation, and wished Mr. Sheedy success in his new sphere. Mr. Sheedy thanked the meeting in a brief speech, acknowledging the support he had received from his colleagues.

Mr. A. KENT has resigned from the position of cable works manager to the Hackbridge Cable Co., Ltd. Communications should be addressed to The Hollies, Belmont Road, Wallington, Surrey. (Telephone: Sutton 996.)

Canterbury T.C. has adopted the recommendation of the Associated Municipal Electrical Engineers (Great Britain and Ireland) so far as the salary of the chief electrical engineer (Mr. BLASCHECK) is concerned, the scale to operate as from April 1st, 1920. Mr. Blascheck's salary is increased from £575 to £640.

Mr. R. G. AVISON, employed by Messrs. E. Brook, Ltd., a second-year electrical engineering student under the scheme of the Huddersfield Engineers' Training Association, is stated in the annual report, just issued, to be the winner of a bronze medal.

Mr. P. H. HARDEN, of the Swansea Corporation engineering department, has been appointed engineering assistant to the Leeds Corporation.

Mr. H. TETLOW, A.M.I.E.E., chief assistant engineer to the Coatbridge and Airdrie Electric Supply Co., Ltd., has been appointed electrical engineer and manager to the Bacup Corporation, at a salary of £450 per annum, plus 5 per cent. bonus on net profits. There were 62 applicants for the position.

Mr. A. S. HAMPTON, M.I.E.E., has been appointed telegraph and electrical engineer to the Caledonian Railway Co., in succession to Mr. W. Stephenson.

Mr. J. H. MEIKLEJOHN, A.M.I.Mech.E., has resigned his position as engineer to the Broughton Copper Co., Ltd., and is proceeding to Australia to take up a similar appointment with the Austral Bronze Co., Botany Road, Alexandria, Sydney.

In the *Metropolitan-Vickers Gazette* for September an account is given of the career of Mr. H. MENSFORTH, C.B.E., M.Sc., late general works manager of the company, who has been appointed Director-General of Factories under the Army Council at the War Office. Mr. Mensforth joined the company as a draughtsman in 1904, and was mainly responsible for the design of its vertical tandem gas engine. He became works manager on January 1st, 1913, when the electrical side of the works, as well as the engine department, came under his control; on December 1st, 1915, he was made general works manager, and on October 3rd, 1917, general manager of works, in which capacity his organising and technical abilities were exercised to the fullest advantage in the national service, he being chairman of the Manchester Armaments Committee. In addition to his administrative and engineering talents, Mr. Mensforth's skill in handling labour questions and his sympathetic attitude towards labour, have gained him a national reputation.

Shoreditch B.C. Special Standing Joint Committee recommends the adoption of the schedule of salaries of the Technical and Clerical Staff of the undertaking as recommended by the National Joint Board of Employers and Staff Members of the Electricity Supply Industry. The effect of the award with regard to the members of the technical staff of the lighting department who are members of the E.P.E.A., is as follows, the award to date from June 1st last:—

Mr. W. Weekes, deputy chief engineer and superintendent of mains, present salary £530, under new scheme to £707; Mr. A. Barbour, resident mechanical engineer, Whiston Street, from £430 to £463 plus residence estimated at £75; Mr. H. Love, resident mechanical engineer, Coronet Street, from £338 to £423 plus residence estimated at £75; Mr. F. C. Ebner, assistant mains and installation engineer, from £390 to £489; Mr. L. Flavell, maintenance engineer, from £338 to £424; Mr. F. V. Wimhurst, assistant mains engineer and draughtsman, from £343 to £430; Messrs. A. East, S. Thomas, A. Pitcher, H. Wimhurst, A. Ridd, and H. Randall, electricians in charge, from £291 to £365; Mr. H. Lawson, electrician in charge, from £283 to £354; Mr. F. Clarke, test room assistant, from £286 to £358.

All members are entitled to receive 5 per cent. increase in salary under new rates due to the undertaking being in District No. 10 (London), also a percentage adjustment of salary in accordance with the variation in the cost of living from 3.6 per cent. to 21 per cent. The recommendations with regard to the clerical staff who are members of the E.S.C.A. are as follows, and are operative from April 1st last:—

Mr. J. A. Williams, present salary and bonus, £349, salary under award £385; Mr. H. W. Elsdon, from £306 to £338; Mr. F. Hodges, from £291 to £323; Mr. H. R. Lloyd, from £276 to £307; Mr. L. Debble, from £247 to £276.

The salary of the Bexhill Corporation assistant electrical engineer (Mr. R. C. CARTER) has been increased from £300 to £375 per annum. It is stated that under the schedule of salaries drawn up by the Joint Board of the Electricity Supply Industry he is entitled to £538.

JAMES CALDWELL, M.Inst.C.E., deputy chairman of Industrials, Ltd., and technical director of several electric welding concerns, has retired from the firm of James E. Sayers & Caldwell, consulting engineers, Glasgow, as from August last. Address, 14-16, Cockspur Street, and Parliament Mansions, Victoria Street, London, S.W. 1.

Will.—Mr. S. H. SANDS, a director of the Old National Telephone Co., left £48,671 net personalty.

NEW COMPANIES REGISTERED.

Harrison Brothers (Electrical Engineers), Ltd. (170,754).—Private company. Registered October 11th. Capital, £6,000 in £1 shares. To carry on the business of electrical, telephone, heating, sanitary, hydraulic, and general engineers, &c. The first directors are: A. Edwards (permanent), Atlas Foundry, Middlesbrough; A. Anderson, 1, Newlands Road, Middlesbrough. Solicitor: H. Outhwaite, Prudential Chambers, Middlesbrough.

Bell Electrical Co. (Northern), Ltd. (170,706).—Private company. Registered October 8th. Capital, £12,000 in £1 shares (2,000 deferred). To take over the business of electricians and electrical and motor engineers at Palatine Chambers, Market Street, Halifax, and to adopt an agreement with B. Bell. The subscribers (each with one share) are: B. Bell, 4, Portland Place, Halifax, electrical engineer; A. W. Smith, 7, Briscoe Terrace, Greetland, master dyer; W. Farrar, Ellwood, Bradford Road, Brighouse, cotton spinner. The first directors are to be appointed by the subscribers. Registered office: Palatine Chambers, Market Street, Halifax.

William Heywood & Son, Ltd. (170,810).—Private company. Registered October 13th. Capital, £10,000 in £1 shares. To take over the business of ironfounders and general engineers carried on by W. Heywood and L. Heywood, at Royton, as "William Heywood & Son," and to carry on the business of electricians, electrical, mechanical, motor, telephone, and general engineers, &c. The first directors are: W. Heywood (chairman), 33, Park Street, Royton; L. Heywood, 500, Rochdale Road, Royton; W. Tattersall, "Oak Dene," Grasscroft, Greenfield; H. Lowe, 1, Church Street, Royton. The two first named are permanent. Secretary: L. Heywood. Registered office: Milton Street, Royton.

Welders, Ltd. (170,850).—Private company. Registered October 15th. Capital, £5,000 in £1 shares. To carry on the business of welders and cutters of metals, by electricity or oxy-acetylene, &c. The provisional directors are: T. Shipley, 105, Clumber Street, Hull, clerk; A. Garton, "Hope Cottage," Anlaby Park, Hull, clerk. Registered office: Imperial Chambers, Bowlalley Lane, Hull.

Hawes Electric Lighting Co., Ltd. (170,842).—Registered October 15th. Capital, £3,000 in £1 shares. To carry on at Hawes, Yorks., the business of an electric light company, &c. Minimum cash subscription £1,000. The first directors are: E. Allen, Hawes, draper; T. Allen, Gayle, Hawes, grocer; S. W. Bowness, Hawes, chemist; G. Coates, Hawes, chemist; J. A. Dinsdale, Gayle, Hawes, farmer; A. T. Iveson, Hawes, auctioneer; W. T. Metcalfe, Hawes, solicitor; W. Raw, Hawes. Qualification: £20. Secretary: H. F. Martland. Registered office: Gayle Mill, Hawes, Yorks.

Wareham Electric Supply Co., Ltd. (170,858).—Private company. Registered October 15th. Capital, £5,000 in £10 shares. To carry on the business as indicated by the title. The first directors are: T. Carter, 2, South Street, Dorchester; Mrs. J. C. Portman, The Priory, Wareham; Mrs. E. G. Filliter, St. Martin's House, Wareham; M. P. B. Portman, The Priory, Wareham. Registered office: 20, South Street, Wareham, Dorset.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dawlish Electric Light & Power Co., Ltd.—Two third mortgage debentures dated September 24th, 1920, to secure £500 each, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: D. Anderson, The Cliffe, Dawlish, and A. Hobson, Redcliffe, Dawlish.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—Return dated July 13th, 1920. Capital, £3,000,000 in £1 shares (2,750,000 ordinary and 250,000 7 per cent. cumulative participating preferred), 2,609,374 ordinary, and 250,000 preferred shares taken up, £2,749,865 14s. paid, £75,900 considered as paid, £33,548 6s. remains in arrears. Mortgages and charges, £8,611 12s. 4d.

Union Cable Co., Ltd. (67,054).—Return dated July 23rd, 1920. Capital, £50,000 in £1 shares. All shares taken up, £50,000 paid. Mortgages and charges, nil. Capital increased to £100,000 in £1 shares on July 29th. Return of allotments made up to August 6th shows the whole of the additional shares allotted for cash.

Lancashire Power Construction Co., Ltd. (77,202).—Return dated July 8th, 1920. Capital, £689,838 in £1 shares (400,000 first preferred, 137,500 preferred, and 152,338 ordinary). All shares taken up, £689,477 2s. paid, £2,400 considered as paid, £6,960 18s. remains in arrears. Mortgages and charges, £288,000.

Tranmere Engineering Co., Ltd.—Debenture dated September 29th, 1920, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital subject to prior charges. Holder: S. F. Grandidge, 27, Park Road South, Birkenhead.

Switchgear & Cowans, Ltd.—Issue on September 30th, 1920, of £1,000 debentures, part of a series already registered.

CITY NOTES.

Electric Supply Corporation, Ltd.—In his speech at the annual meeting, held on October 15th, the chairman (Mr. J. G. B. Stone) referred to the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, and said that during the year they were able to enter into revised agreements in all but three of their undertakings. The position to-day was, therefore, very much better, as they received a considerable addition to their pre-war rates in all their undertakings. It was, however, necessary to obtain still further advances, and steps were being taken with that object. He was pleased to say that the Ministry of Transport, which now controlled their destinies, was apparently looking with a more favourable eye on the claims put forward by the electric supply industry, and they were no longer debarred from making application for increased rates under the Electric Lighting Acts. The rates fixed under such procedure did not involve any curtailment of their dividends, and it was their intention to take advantage of this method in due course. The rates so fixed could not be changed for five years; it was, therefore, advisable to wait until they saw some sign of an arrestment in the rapid increase in the cost of labour and material.—*Financier.*

Brampton Brothers, Ltd.—Final dividend on preference shares at the rate of 6 per cent. per annum, ordinary shares 10 per cent.; £20,000 to reserve, and £8,894 carried forward.

Stock Exchange Notices.—The Committee has ordered the following to be officially quoted:—

Canadian General Electric Co., Ltd.—$754,400 common stock.

Dealings in the undermentioned have been specially allowed by the Committee, and the shares are now included with those in which special settlements have been granted:—

Para Telephone Co., Ltd.—60,000 ordinary shares of £1 each, fully paid (Nos. 1 to 60,000).

Erinoid, Ltd.—For the year ended August 31st, 1920, the total profits amounted to £70,136; after allowing for company charges, depreciation, &c., the net profits were £64,162, which with the amount brought forward totalled £65,230, from which £35,000 has been transferred to reserve, and a dividend is now recommended of 15 per cent., making 22½ per cent. for the year, less tax, leaving £2,668 to be carried forward. The report states that supplementary premises at Yale, Glos. (formerly an aeroplane repairing station), have been acquired from the Disposal Board; when fully equipped, the new factory will enable the output of Erinoid to be practically doubled.

Companies Struck off the Register.—The following are to be struck off the register within three months unless cause is shown to the contrary:—

British Prometheus Co., Ltd.
Diaphone Co., Ltd.
Hemming Conduit Grip, Ltd.
Llanelly Motor & Engineering Co., Ltd.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. on the ordinary shares, free of tax, for the half-year to June 30th.

Indo-European Telegraph Co., Ltd.—Interim dividend for the June half-year at the rate of 5 per cent. per annum, free of tax.

Norwich Electric Tramways Co., Ltd.—Profit for the year £10,864, plus £167 brought forward, total available balance £11,031, to be appropriated as follows: £714 is put to writing down cost of turbo-generator, and the balance, £10,317, to the reserve fund.

Anglo-American Telegraph Co., Ltd.—Interim dividend for quarter ended September 30th of 15s. per cent. on the ordinary stock and 30 per cent. on the preferred stock, less tax.

Pope's Wire Lamps.—The shareholders in the N. V. Pope's Metaaldraad Lampenfabriek of Venlo, Holland, have sanctioned an increase in the share capital by the issue of 800 new shares of 1,000 fr.

Direct United States Cable Co., Ltd.—At a meeting held at Winchester House on Tuesday last the resolution approving the sale to the Government was unanimously adopted.

Calcutta Tramways Co., Ltd.—Interim dividend of 3½ per cent., free of tax, on ordinary shares.

Electrical Utilities Corporation, Ltd.—Dividend of 1¼ per cent. on preferred for quarter ended September 30th.

Trafford Park Estates, Ltd.—Dividend 8 per cent.; carry forward £84,269.

STOCKS AND SHARES.

Tuesday Evening.

It would be a very good thing if the miners' strike could be left out of the account of Stock Exchange happenings in regard to electrical markets during the past week. Like King Charles' head in Mr. Dick's book, it is, however, bound to come in, being the determining factor which has made prices alternately depressed and a little less so. Business is jogging along in a quiet sort of way, and Stock Exchange opinion expresses some little surprise that quotations should keep up as well as they do. The fact that there is no particular slump in any of the markets points not only to the fact that the public are refusing to sell to any large extent, but also implies that there is a certain amount of buying going on at the same time. Would-be sellers find that it is not easy to transact their business always at the lower of the two quotations furnished. This phase has been mentioned several times here of late. With everybody on the tiptoe of expectation that the strike may be settled with unexpected promptitude, there are few who care to sell unless they are in need of money. On the other hand, nobody wants to buy Stock Exchange securities while everything is on the lap of the gods.

Investment stocks are maintained with firmness. The word "Revolution" is heard every now and then, and the humorists profess that they are laying in steel waistcoats against the time when Irish methods may become common in the streets of London. It is in those departments which are immediately affected by the coal strike where weakness is most apparent, and colliery shares naturally have fallen, together with those in the shipping, iron and steel markets. Railway stocks are dull, but not worse than that. Underground Electric incomes have given way 3 points to 68½, and the £10 shares fell ¼ to 2¾, while the 1s. shares are nominally 7s. The company advertises that the raising of fares has resulted in a slight falling off in the number of passengers carried, but points out that the omnibus traffic suffered some disadvantage during the first week of the increased fares, owing to weather conditions. So far as Underground incomes are concerned, it is apparent that optimism went a little too far in rushing up the price some 10 points in less than a fortnight, because it is scarcely to be expected that the company will be able to pay anything like the full dividend of 6 per cent., free of tax, on these bonds in respect of the current six months. If curtailment of train services becomes necessary, this is bound to affect receipts also, but where uncertainty prevails at every step, it is useless to attempt straying into the paths of prophecy in regard to the future that lies just ahead.

A good deal of surprise has been caused by Direct United States Cable shares going back to 5½ in spite of the offer of the Government to the company on terms which are likely to work out to the advantage of holders at anything under £6. The market estimate ranges between £6 10s. and £6 15s. as the ultimate value of the shares when the liquidation is at an end, but in the meantime the shares can be picked up in the neighbourhood of 5½, so that there is at least the chance of a good interest for those who are content to put them away for some little time. It is just the uncertainty as to how long this time will be that prevents investors from buying Directs at the present moment. Other cable shares are steady, although Eastern Telegraph new shares eased off a trifle to 17s. 9d., and there is some little hesitation in other members of the group, due simply to the fact that nobody wants to buy anything while the coal strike remains in suspense. Globe preference are better at 8½. It may be noted that Eastern ordinary stock, Eastern Extension shares and Westerns are now all standing at the same level.

Anglo-American deferred receded to 17¼. Marconis are heavy at 2 11/16, at which price they can be bought, while Canadians are 9s. 6d. and Marines 28s. 6d. Oriental Telephones at 2¾ are ex the dividend just paid.

It is in such shares as Babcock & Wilcox where the coal strike effect is heavily felt. Babcocks have gone back to 2¾, and other engineering shares are depressed. Edisons at 19s. are 1s. 6d. down. General Electrics at 25s. 9d. show a fall of

1s. 3d., and Siemens receded to 24s. Nor are the other shares in this manufacturing group by any means firm, and when sellers come to test the nominal quotations, they, the sellers, are apt to feel disappointed at the result. Electric lighting shares are a trifle unsteady. A fall of ¼ in St. James's ordinary left the price 6¼. Bromptons have gone back to 6½. South Londons retained their rise at 2½. Notting Hill 6 per cent. preference weakened to 7¼. Chelseas rose to 3. Here also the market is somewhat nominal, and the electricity supply section is one in which business has become almost a matter of negotiation.

Mexicans have not benefited by the renewed assurance of General Obregon, the new President, to the effect that his country will meet its obligations to foreign creditors. Mexican Light and Power bonds shed another 3 points, and Mexico Tramways sixes are 2 lower, at 32. Brazilian Tractions weakened to 44, a drop of 2½. Anglo-Argentine Tramways first preference are now quoted at 3 ex the 5s. 6d. just paid on account of arrears. British Columbia Electric preferred and deferred have both moved up 3 points. Kaministiquia common hardened to 115½, and the 5 per cent. bonds to 97. The pound sterling has again fallen in relation to the dollar in consequence of the coal strike, and all "dollar" securities have advanced.

Vickers, Armstrongs Explosive Trades and other armament shares have given way. Vickers at 20s. 3d. stand lower now than they have done since the shares were split into their present £1 form in 1897. In the rubber market, continued weakness of the raw produce combines with general conditions to keep the market flat. A fair amount of adhesion to the recent proposal of curtailment of output by 25 per cent. on the part of rubber-producing companies has been obtained, and the experiment will start on November 1st.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Oct. 19, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary..	8	13	6½	– ¼	£9 16 0
Charing Cross Ordinary	4	7	9½	–	10 15 6
do. do. do. 4½ Pref. ..	4½	4½	9½	–	8 9 8
Chelsea	3	4	3	+ ½	6 13 4
City of London	8	10	1½	–	8 17 10
do. do. 6 per cent. Pref. ..	6	6	17/6	–	6 17 2
County of London	7	8	7½	–	10 17 6
do. do. 6 per cent. Pref.	6	6	8½	–	7 7 8
Kensington Ordinary	6	7	8½	–	9 0 6
London Electric	Nil	2½	1½	–	6 0 0
do. do. 6 per cent. Pref...	6	6	9	–	13 0 0
Metropolitan..	5	6	9½	–	10 8 8
do. 4½ per cent. Pref. ..	4½	4½	9½	–	8 0 8
St. James' and Pall Mall	10	12	6½	– ¼	9 4 5
South London	6	6	2½	–	9 12 0
South Metropolitan Pref.	7	7	10.8	–	8 12 8
Westminster Ordinary	8	10	8	–	10 0 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	77½	–	7 14 10
do. Def.	83/6	1½	17½	– ¼	8 15 10
Chile Telephone	6	6	8½	–	*5 9 1
Cuba Sub. Ord.	7	7	7	–	10 0 0
Eastern Extension	8	10	14½xd	–	*8 18 7
Eastern Tel. Ord.	8	10	14½xd	–	6 15 7
Globe Tel. and T. Ord.	8	10	14½	+ ½	6 16 9
do. do. Pref.	6	6	8½	+ ½	7 1 2
Great Northern Tel.	22	22	20	–	11 0 0
Indo European	13	10	80	–	8 8 8
Marconi	25	25	9½	– ⅛	9 6 2
Oriental Telephone Ord.	10	12	13xd	– ¼	*4 18 4
United R. Plate Tel.	8	8	6½	– ½	*8 10 8
West India and Panama	1/8	Nil	1½	–	Nil
Western Telegraph..	8	10	14½	+ ½	*8 15 7
Home Rails.					
Central London Ord. Assented ..	4	4	43½	–	9 4 0
Metropolitan	1	1½	21	– ½	6 19 1
do. District	Nil	Nil	18½	– 1	Nil
Underground Electric Ordinary..	Nil	Nil	2½	– ½	Nil
do. do. "A" ..	Nil	Nil	7	– 6d.	Nil
do. do. Income ..	5	4	68½	– 3	—
Foreign Trams, &c.					
Anglo-Arg. Trams First Pref. ..	Nil	5½	8xd	–	9 3 4
do. do. 2nd Pref. ..	Nil	Nil	32	–	Nil
do. do. 5 Deb. ..	5	5	57½	–	8 18 10
Brazil Tractions	Nil	Nil	44	– 2½	Nil
Bombay Electric Pref.	6	6	12½	–	4 16 0
British Columbia Elec. Rly. Pfds.	5	5	54	–	9 5 2
do. do. Preferrred	5½	5	53½	+3	*8 10 10
do. do. Deferred	Nil	3	53½	+3	*5 10 10
do. do. Deb. ..	4½	4½	63½	–	7 19 8
Mexico Trams 5 per cent. Bonds..	Nil	Nil	44	–	Nil
do. 6 per cent. Bonds..	Nil	Nil	32	– 2	Nil
Mexican Light Common	Nil	Nil	15	–	Nil
do. Pref.	Nil	Nil	27½	–	Nil
do. 1st Bonds	Nil	Nil	50	– 3	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	9½	– ½	*8 19 4
British Aluminium Ord.	10	10	15/9	– ⅛	10 18 4
British Insulated Ord.	15½	15	14½xd	–	8 17 10
Callenders	25	15	1/3	–	10 8 8
do. 6½ Pref.	6½	6½	15/9	–	6 18 8
Cartser-Kellner	20	17	8	–	5 12 4
Crompton Ord.	10	10	17/6	–	11 8 6
Edison-Swan, "A"	10	10	19/-	– 1/6	10 10 8
do. do. 5 per cent. Deb. ..	5	5	75½	– 1	6 12 6
Electric Construction	15	15	15/3	–	19 19 2
Gen. Elec. Pref.	6½	6½	13/6	–	7 8 5
do. Ord.	15	15	25/9	– 1/6	*7 15 4
Henley	20	15	13	–	9 4 8
do. 4½ Pref.	4½	4½	8½	–	7 4 0
India-Rubber	10	10	25	–	*8 0 0
Met.-Vickers Pref.	—	5	15½	–	7 6 2
Siemens Ord.	10	10	24½	– 6d.	*8 6 8
Telegraph Con.	20	20	20	–	6 0 0

* Dividends paid free of Income Tax

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, October 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£92	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£41	..
a Copper Sulphate	"	£42	..
a Potash, Chlorate	per lb.	1/-	..
a " Perchlorate	"	1/8	..
a Shellac	per cwt.	£82 10s.	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a " Lump	"	£22	..
a Soda, Chlorate	per lb.	6d.	..
a " Crystals	per ton	£15	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £800	..
c Brass (rolled metal 9" to 12" basis)	per lb.	1/3½	½d. dec.
c " Tubes (solid drawn).. ..	"	1/5½ to 1/5¾	½d. dec.
c " Wire, basis	"	1/5½	½d. dec.
c Copper Tubes (solid drawn) ..	"	1/8½	½d. dec.
c " Bars (best selected) ..	per ton	£115	£7 dec.
c " Sheet	"	£157	£7 dec.
c " Rod	"	£157	£7 dec.
d " (Electrolytic) Bars ..	"	£114	..
d " " Sheets ..	"	£158	..
d " " Wire Rods..	"	£130	..
d " " H.C. Wire ..	per lb.	1/4½	..
f Ebonite Rod	"	8/6	..
f " Sheet	"	8/-	..
n German Silver Wire	"	8/-	..
h Gutta-percha, fine	"	14/-	..
h India-rubber, Para fine	"	1/6	..
i Iron Pig (Cleveland Warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£29	..
g Lead, English Pig	"	£37	£1 inc.
g Mercury	per bot.	£15 to £15 5s.	£3 dec.
e Mica (in original cases) small ..	per lb.	6d. to 4/6	..
e " " " medium ..	"	5/- to 10/-	..
e " " " large ..	"	12/6 to 25/- & up	..
p Phosphor Bronze, plain castings	"	1/6 to 1/11	..
p " " rolled bars and rods	"	2/5 to 2/8	..
p " " rolled strip & sheet	"	2/5 to 2/9	..
d Silicium Bronze Wire	per lb.	2/-	..
r Steel, Magnet, in bars	"	1/8	..
n Tin, Block (English)	per ton	£240	£18 to £19 dec.
n " Wire, Nos. 1 to 16	per lb.	4/9	..
p White Anti-friction Metals ..	per ton	£78 to £800	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
p ——————
r W. F. Dennis & Co.

Ex-Westinghouse Re-union.—The third annual re-union dinner of the ex-British Westinghouse Association will take place at the Holborn Restaurant, on March 18th, 1921. Inquiries should be addressed to the hon. secretary, Mr. L. S. Richardson, 14, Sydney Road, Richmond, Surrey.

Portland Cement: British Standard Specification.—A revised edition of the B.S. specification for Portland cement, Report No. 12, 1920, has recently been issued by the British Engineering Standards Association. The B.S.S. was originally issued in 1904, and has been revised from time to time. The present edition supersedes that published in 1915, and the following are the principal modifications which have been made:—

A paragraph has been inserted making clear that no cement to which slag has been added, or which is a mixture of Portland cement and slag, will comply with the specification. Provision has been made for sampling cement when stored in deep silos, and the specific gravity test has been eliminated. The aeration of cement before testing for setting time has also been dispensed with, and a provision has been inserted permitting the deduction from the total lime content of the proportion of lime necessary to combine with the sulphuric anhydride present when calculating the lime ratio.

The medium and slow setting cements have been replaced by a grade having a minimum initial setting time of 20 minutes, and a maximum final setting time of 10 hours; in addition the quick setting cement, which formed one of the three standard grades, is retained in the specification, but is only to be supplied if specially required.

A minimum final setting time is not now specified, and the clause relating to the supply by the vendor, free of cost, of a certificate that the cement has been tested and analysed and complies in all respects with the specification, has been modified to provide that if such a certificate is required it must be so specified at the time of purchase.

The specification may be obtained from the B.E.S.A., 28, Victoria Street, S.W. 1.

ELECTRICITY IN AGRICULTURE.

Devices for Tapping Overhead Distribution Mains, and Equipment for Electric Ploughing.

By R. E. NEALE.

(*Concluded from page* 508.)

The Equipment Recommended.—The equipment recommended by M. Guedeney as conforming to the above desiderata operates on the Howard "roundabout" system, and is illustrated diagrammatically in fig. 4. The motor is served by a transformer connected to the overhead distribution lines, and is mounted together with two cable drums on a four-wheeled truck. From the cable drums two cables pass in opposite

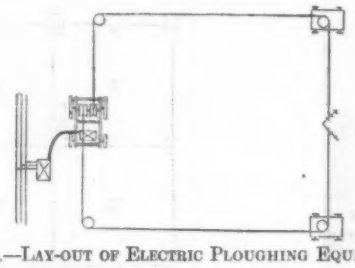

Fig. 4.—Lay-out of Electric Ploughing Equipment.

directions round pulleys at the corners of the field to the plough, which is of the double, tilting, type. The pulleys at the ends of the furrow are on wheeled trucks (with automatic anchorage) in order that they may be moved laterally after ploughing each line of furrows.

The Howard arrangement of tackle is still used very extensively for steam ploughing in Italy, there being from 150 to 200 installations on this system compared with ten or twelve Fowler installations. In France, on the other hand, the Fowler system is preferred as more powerful and capable of being moved rapidly from place to place under its own power. Electrical ploughing equipment, however, is "dead" directly the connection to the distribution mains is interrupted, hence provision must be made to move it from field to field by animal traction, by tractor, or by auxiliary engine. For this reason it is preferable to use a stationary windlass rather than work on a system which requires the windlass to be moved frequently. Other advantages of the stationary windlass system are: (1) The motor can be placed at the position most convenient from the point of view of supply; (2) the distance from transformer to motor may be kept short, hence the motor may be operated at low voltage; (3) the repeated unrolling and rolling-up of flexible cable is eliminated.

Motor and Windlass.—The truck illustrated in fig. 5 carries a squirrel-cage induction motor of from 30 to 50 h.p., wound

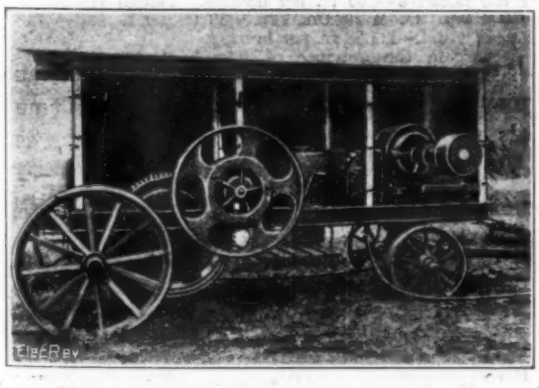

Fig. 5.—Electrically-driven Windlass.

for any desired pressure between 200 volts and 500 volts. The control is the simplest possible, a lever being pushed in one direction or the other according to the direction in which the plough is to be moved. The normal effort at the windlass is 3 tons, or about 2 tons at the plough.

Anchor Trucks.—Contrary to expectations, the author found that anchor-trucks of the type shown in fig. 6 with disks attached to the wheels, obtained a satisfactory hold even on hard, dry, stony soil in which the disks penetrated only 10 cm. It is necessary (for efficiency) that the four disks should engage cubes of earth far enough apart to produce a total resistance equal to four times that of one disk. The cable pulley is placed as near as possible to the ground in order to reduce the overturning moment. The total weight of the apparatus is about 1 ton, and an earth bucket is provided to make possible additional loading for very heavy ploughing.

A small drum at the back of the anchor truck carries a cable which is hitched and tightened when starting work. When the plough approaches the anchor-truck a catch is released (either by hand or automatically by a button on the cable),

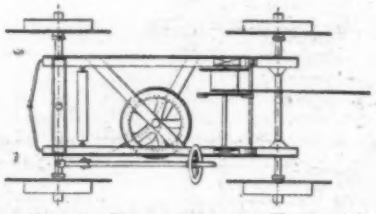

Fig. 6.—Plan of Anchor Truck.

and the tension in the plough cable then pulls the anchor-truck along, into position for the next line of furrows. The truck illustrated has never been known to drag out; under abnormal efforts of 4½ to 5 tons it has sometimes tipped over, but always without injury.

Fixed Anchors.—It is necessary to anchor the windlass, the two fixed pulleys, and the ends of the cables holding the anchor-trucks. This operation takes about 15 minutes per anchor, and on farms organised definitely for electric ploughing it may pay to provide permanent anchorages in each field.

Haulage Cables.—There is considerable frictional loss and wear if the haulage cables be allowed to trail on the ground, but if supporting idler pulleys be used, the mechanical losses in the cable are reduced to about the same value as the electrical losses in the trailing cables needed where the double mobile windlass system is used.

Fig. 7.—Portable Transformer Cabin.

Transformer Cabins.—The transformer cabin illustrated in fig. 7 is simple in construction, and weighs about 2,000 kg. in service condition. The equipment includes open-air switches or interrupters, fuses, and choke coils, but no lightning arresters, because it is seldom possible to make a good earth connection. A meter and low-voltage switch are placed in a box isolated from the h.t. equipment.

The Plough.—This is the part of the equipment which invariably engages the principal attention of the farmer, and

on which depends primarily the quality of the work done. The number and shape of the blades must be varied to suit individual circumstances. The ploughs used by the author are of the tilting, double-ended type, and, with a normal effort of 2 tons, they effect subsoil ploughing 40 cm. deep with a single blade, ploughing 30 to 35 cm. deep with two blades, and 25 to 30 cm. deep with three blades. Fig. 8 shows an anchor-truck and a plough in use.

Use in the Field.—Taking the equipment to the field, making the necessary anchorages, and paying-out and fixing the cables occupies two men and three horses for ½ day or 1 day. The ploughman signals to the man at the windlass by a flag. At the end of a furrow he signals "stop," reverses the plough, releases the catch permitting the anchor-truck to be moved forward, and signals "start." These operations occupy about 40 seconds.

In the case of an open range of fields extending in all directions, the windlass may be placed as in fig. 9, four areas

Fig. 8.—Anchor Truck and Tilting Plough in Use.

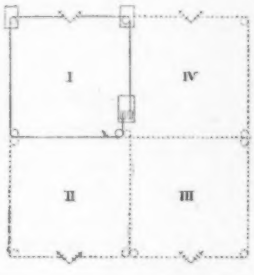

Fig. 9.—Ploughing a Square Block of Fields.

of about 9 hectares being then ploughed in the order shown. One can also plough squares of 9 hectares in front and behind. Generally, however, fields flank roads and extend often for great lengths, with a depth of 300 to 400 m. In such cases the windlass is placed alongside the road in position a_1, fig. 10, and, after ploughing field I, the anchor-trucks and plough are in position for field II, so that it is only necessary to move the windlass to a_2, and the fixed pulleys from c_1 d_1 to c_2 d_2. Where applicable, this arrangement has the advantage that the windlass (weighing 5 or 6 tons) is kept on hard soil near the road (hectare=10,000 sq. m.=2½ acres).

Distribution.—On a large estate the most simple and reliable arrangement is to establish a H.T. intake and metering station with permanent H.T. or L.T. distribution lines, radiating

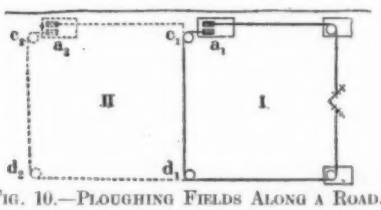

Fig. 10.—Ploughing Fields Along a Road.

thence, and controlled by interrupter switches. These lines lead to the various positions for the windlass transformer cabin. The capital expenditure on such distribution lines is justified by the convenience and reliability of service secured, and the author considers that this is the system of the future. In the meantime, however, in order to reduce expenses, it may be necessary to use temporary lines or flexible cables. With 600 to 700 m. of temporary line a zone of 1,000 m. on either side may be served, corresponding to 5 m. of permanent line per hectare, the permanent lines being 2 km. apart. For example, the transformer cabin on the H.T. line at the centre of fig. 11

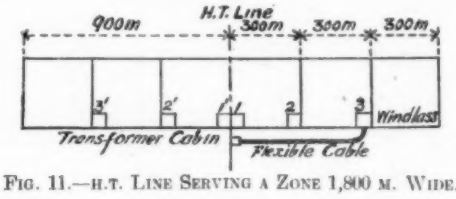

Fig. 11.—H.T. Line Serving a Zone 1,800 m. Wide.

serves, through a flexible trailing cable, three windlass positions on either side of the line. With a motor voltage of 500 volts and a 3-core 20-sq. mm. trailing cable, the maximum pressure drop is 7 or 8 per cent. for a 30-H.P. motor.

The establishment of distribution lines for electric ploughing and other field services cannot fail to lead to the extensive use of electrical energy for lighting and power purposes in general.

Test Data.—The author's tests were made on M. Hamot's farm near Beauvais, the ground being undulating, argilo-calcareous with numerous stones (flints of 8 to 10 cm.). The farm was crossed by a 15,000-volt line, served by two 80-H.P. sets. The only labour used for the electric ploughing was one farm labourer and one daily labourer; their training in the manipulation of the plough and windlass occupied only four hours.

During the period September 10th to October 20th a patch of exceptionally stony ground, in very dry condition, was ploughed 30 to 35 cm. deep with two blades. The load on the motor exceeded 100 amp. at 500 volts, hence one blade was removed, and the soil was then lifted in blocks measuring 60 to 80 cm. across. This constituted heavy subsoil ploughing, and the energy consumption was 180 KW.-hours per hectare, the rate of ploughing being 0.1 hectare per hour. After the rains much more rapid progress was made, and the better portions of the farm were dealt with. Ploughing 28 to 30 cm. deep with two blades, the energy consumed was 75 KW.-hours per hectare and 2.4 hectares were ploughed in seven working hours.

Costs.—The cost of ploughing 30 cm. deep, using the electrical equipment described, is given as 112 fr. per hectare (about 36s. per acre). This assumes the use of a C.E.M. (Compagnie Electro-Mécanique) electric windlass, costing 100,000 fr., including plough and 500 m. of mobile line. The energy consumption is taken to average 90 KW.-hours per hectare, and the performance 2.5 hectares per day.

In order that the cost figures may be modified to suit individual cases, the various items may be specified in detail:—

Working Expenses.—Electricity, 90 KW.-hours at 0.4 fr.= 36 fr. per hectare. Labour, two men at 10 fr. for 2½ hectares =8 fr. per hectare. Reforging plough shares, 3.2 fr. per hectare. Lubricating oil, 0.5 fr. per hectare.

Transport and Erection of Equipment.—Two men at 10 fr. and three horses at 10 fr. for about one day per 8 hectares= 6.25 fr. per hectare.

Capital Charges.—Depreciation, 7.4 per cent.; interest, 6.5 per cent on 100,000 fr. per hectare.

Repairs.—One cable (750 kg. at 3.5 fr.) per two years, *i.e.*, per 600 hectares=4.35 fr. per hectare. Plough repairs, 3 fr. per hectare. Other repairs, say, 4.35 fr. per hectare.

Grand Total.—111.98 fr. per hectare.

Farmers in the province of Rovigo (Italy) using similar equipment estimate the cost of ploughing 40 cm. deep to be from 100 to 120 lire per hectare (32s. to 38s. 6d. per acre) using electricity at 0.2 lire (1.9d.) per KW.-hour.

This cost is only about 25 per cent. to 35 per cent. that of ploughing by horse labour or by oxen, the basic data in these cases being: Wages, 10 fr. per day per man; horse feed, 15 fr. per day; depreciation, 1 fr. per day per horse, and 0.55 fr. per day per ox; harness, 0.5 fr. per day per horse and 0.15 fr. per ox; shoeing, 1 fr. per day per horse and 0.5 fr. per ox; Belgian plough, 10 fr. per day. On these bases the total costs of ploughing by horses and oxen are as follows:—

		Ploughing 30-35 cm. (12-14 in.) deep.	Ploughing 25-35 cm. (10-14 in.) deep.	Ploughing 18-25 cm. (7-8 in.) deep.
By Horse	per hectare	490 fr.	302.5 fr.	170 fr.
	per acre	157s.	97s.	54s. 6d.
By Oxen	per hectare	434 fr.	186 fr.	164.5 fr.
	per acre	139s.	91s. 6d.	52s. 8d.

The above figures for mechanical and animal ploughing relate to the same hard soil. On lighter soil the rate of ploughing would be higher and the cost lower, but the relative costs of the electrical and animal ploughing would remain about the same. Whilst it is true that the farmer using electric ploughing tackle will probably retain the same number of beasts as he would otherwise require, the electrical equipment will enable him to cultivate land more thoroughly, more rapidly, and at the exact time desired. The superiority of the windlass system is naturally greater the heavier the ploughing, and if the effort required is only a few hundred pounds it is more economical to use horses or oxen than a motor of 30 to 50 H.P.

Conclusions.—The particular installation described was purchased by M. Hamot on the completion of the tests, and the owner is well satisfied with the results obtained. Ploughing can be done whenever desired, whether the soil be wet or dry, and deep cultivation is effected. Only two men are needed for the ploughing. From the supply standpoint we have the rather remarkable fact that a small station containing two 80-H.P. sets, and already supplying a considerable load, can supply the ploughing demand without difficulty.

The general adoption of electric ploughing would pave the way to other important agricultural applications of electrical energy, but a vital factor in this development will be the production of ploughs and other tools and machinery which meet the requirements of the farmer as well as being suitable for electric driving. There is no reason why the agricultural load should not be equivalent to 800 or 1,000 hours of use per annum (say 10 to 12 per cent. load factor), but in order to accelerate agricultural developments, central stations must offer favourable terms to pioneers. The average farmer is ultra-conservative, and the only argument which will convince him quickly concerning the possibilities of electricity in agriculture is a demonstration of electrical equipment actually operating in his neighbourhood. The ultimate success of electricity in agriculture cannot be doubted, and it is up to the central station engineer to overcome the initial difficulties, and make the investment demanded by pioneering installations. In this good work they should receive the assistance of electrical and agricultural manufacturers, whose interests are equally involved.

ELECTRICITY SUPPLY IN LONDON.

Inquiry held by the Electricity Commissioners.

(*Concluded from page* 512.)

When the proceedings were resumed in the afternoon,

Mr. Lloyd informed the Commissioners that it had just been brought to his notice that Sir Ernest Hiley had ceased to be the chairman of the County of London Electric Supply Co., Ltd. The Chairman said he could not very well ask the late chairman of the company to give evidence, but he would like somebody to give an authoritative view as to the policy of the company. Sir Harry Renwick, as the acting chairman of the company, explained that Sir Ernest Hiley's resignation had not yet been officially announced, and that was why he had given the answers he had previously given.

The Chairman said the Commissioners were convinced that it would be in the best interests of London as a whole if all the companies and local authorities concerned with electricity supply were to pool their resources and their brains in an endeavour to devise a comprehensive scheme. Would it be practical to suggest that all the technical advisers, including those of the County Co., should meet and that the inquiry should be adjourned for a short time for that purpose? Mr. Lloyd said he did not think it would be much use adjourning the inquiry if the opposition held to the view that on no account must the Barking station be erected as soon as possible. Mr. Jones said a vast amount of information had been collected, but it was too early to say yet whether Barking would be the best site or not.

The Chairman said that the Commissioners were satisfied that there was a shortage of power in London, and that the needs of London must be met during the next three or four years. He did not wish to create delay in meeting those needs by refusing sanction to a scheme such as was now before the Commissioners if there was no likelihood of an alternative scheme being brought forward. Mr. Jones assured the Commissioners that those for whom he appeared recognised to the full the serious need for improving the electricity supply of London, but the proposal now before them did not pretend to deal with the position during the next three or four years. It was only in 1925 that it was hoped to have the Barking station working, and, therefore, the needs of London meanwhile would have to be met in some other way. To hold back consent to the erection of the proposed station at Barking until the comprehensive scheme had been presented could in no way prejudice the position of the future supply after 1925.

After a short consultation among the parties it was found that they could not agree to meet in the manner suggested, and it was decided to proceed with the case.

The Chairman said the Commissioners would desire to have very clear proof by the opposition that the growing needs of the County Co. could be met in some other way than that proposed by the company. The Commissioners were not going to adopt a policy of sterilisation or undue delay: there had been too much delay in the London problem already.

On Friday, October 8th, Mr. Tyldesley Jones said that it was material to bear in mind, in relation to the question of the time when the power station could be brought into operation, that the company could not connect it with its London area without the consent of the Minister of Transport, before whom opposition could be heard. At the same time, he contended that the normal development of electricity supply in London would have to be dealt with in a temporary manner until 1924, which was the date upon which the County Co. anticipated getting its Barking station into operation. That difficulty, however, was one which was common to all the London supply authorities, and, so far as the County Co. was concerned, it already had a contract for 10,000 kw. with the City Co., and on the south side of the River Thames there was the South Metropolitan Electric Light and Power Co., Ltd., with its Lewisham station, which had a capacity of 20,000 kw., and a load of only 8,500 kw. That showed that the increase in demand between now and 1924 could be met in a temporary manner. The Chairman said that the Commissioners were aware that in the majority of London stations there was a great shortage of plant, and he did not know how many stations there were which could give a temporary supply such as had been referred to. Mr. Jones said that 150,000 kw. of extensions were now in hand in London, and he repeated that the Commissioners should not deal with the prospective future demands of London without taking the whole question of the area and the proper sites for the power stations into consideration. The County Co.'s scheme should be considered from two points of view: was it one that had been suggested merely for the needs of the County Co. alone, in which case it partook of the parochial nature, and should be refused on that ground, or had it an ulterior motive, as being a first instalment of the comprehensive scheme which the Commissioners were to inquire into in March next year? In that case, again, it should be refused, because it meant that the big problem would be pre-judged, to the disadvantage of those who had taken the advice of the Commissioners and joined forces in order to produce a comprehensive scheme. Already West Ham and some other authorities had joined in a scheme for the erection of a large power station at Dagenham. All the plans had been prepared, but, in deference to a request by the Commissioners, an application to erect that power station had been postponed. Further, the information which his engineers had been collecting since they were invited by the Commissioners in July last to prepare a scheme was that Barking was not necessarily the best site, having regard to the needs of London as a whole, nor that there would only be one large power station in the area. If a large comprehensive scheme could be sanctioned by the Commissioners as soon as possible after March next year it would be possible for the joint electricity authority to have its power station in operation by 1925, at the same time as the County Co. anticipated the station now proposed would be ready.

The Chairman asked Mr. Jones if he seriously thought that a scheme of this magnitude could be presented to the Commissioners in March, full consideration given to it, ratification given by Parliament, the authority set up and the station working in 1925? It seemed to him that it would be impossible even to set up the authority until 1922. Mr. Jones said that under Section 18 of the Electricity (Supply) Act, 1919, the Minister of Transport himself could take action, and by the time the electricity authority was formed the scheme which his engineers were now preparing would be so far forward that there would be a strong case for the Minister to take action. In any event, he asked that the Commissioners should not prejudice the schemes which the Commissioners themselves had asked for; they had actually asked some of those interested in preparing those schemes to hold their hands. Finally Mr. Jones, on the assumption that the Commissioners would grant the Order, asked that the capacity of the power station should be limited strictly to the requirements of the County Co., and that nothing should be sanctioned which would in any way prejudice or take away the rights of those who were now engaged upon the large scheme at the request of the Commissioners themselves.

Mr. J. H. Rider said that the scheme now being prepared was on the basis that the County Co. would be included in the area of any electricity supply authority which might be formed after consideration of the schemes in March next year. At present the committee of engineers which had been appointed by the joint authorities had not all its information available, but figures which had been collected showed that, compared with fifteen years ago, when the Barking site was first suggested as suitable for a power station, the total capital charges on such a station had increased nine times, and the altered circumstances demanded very careful consideration. In the scheme, which would be put before the Commissioners in March by the joint authorities, it was possible that a power station would be included on the south side of the River Thames as well as one on the north side, but he was emphatically of opinion that no new station should be sanctioned in the area until the Commissioners had held their inquiry next March, always bearing in mind that the normal demand during the next three or four years, during which time it was generally agreed that a new large power station should not be erected, could be met by temporary expedients, which had been indicated during the proceedings. At the present time 200,000 kw. of new plant had been authorised and was on order, and although about 50,000 kw. would replace old plant, there were many possibilities for the County Co. to obtain a supply to help it along until the joint scheme was decided upon. Any large power station of this character should be built by the joint authority and not by an individual undertaker.

The Chairman said that the Commissioners had been impressed by the fact that local authorities throughout the country were rather reluctant to spend large sums of money on big electrical schemes owing to the difficulties which they had experienced with regard to borrowing money for housing

schemes, and he asked witness what would be the position of the Commissioners if, when the joint scheme was submitted in March, it was found that difficulties would be encountered with regard to finance. Mr. Rider said that point would be gone into very fully in the joint scheme when it was submitted in March.

Mr. C. H. Wordingham said he represented 38 local authorities in the London and Greater London areas. The question of site was a very important one, having regard to the increased cost of laying mains. The cost of the transmission mains was about £1 per kw. per mile, so that an error of a mile in the location of the power house in relation to the centre of gravity of the load meant a loss of £500,000. It was not at all certain either that one power station would be sufficient to meet the needs of London, and there was evidence that other people thought the same, because a company, with which the County Co. was associated, proposed to erect a power station at Erith. The Chairman, referring to the question of meeting the demand between now and 1924, said there was a serious shortage in Barking and East Ham. Mr. Wordingham said that West Ham could give a supply, because it had a capacity of 27,900 kw. and a maximum demand in 1919 of 11,450 kw. Stepney, too, had a maximum demand of 10,800 kw. in 1919 and a plant capacity of 16,000 kw., with 10,000 kw. on order. Shoreditch also had a maximum demand in 1919 of 6,440 kw., a plant capacity of 8,000 kw., and 5,000 kw. on order. The Chairman said that nevertheless important business could not be taken on in some parts of London, and there was a recent case of a 5,000-kw. chemical works load on the banks of the Thames which had had to be refused. Mr. Wordingham, on the general question, contended that the Commissioners would be fully justified in postponing a decision with regard to this application until after the joint scheme had been presented in March next year. In fact, he did not think they would be justified in coming to a decision now because they had not all the evidence before them.

Sir Alexander Kennedy had no hesitation in saying that if a Joint Electricity Authority were created in 1922 a new power station could be in operation in three years' time. Even if it were a question of a delay of a year, that would be better than giving consent to a scheme such as was now proposed, which would only stand in the way of the proper preparation of a full scheme. The Chairman said the Commissioners thought it desirable that the chairman or somebody connected with the Conference of Local Authorities and Companies should give evidence, because they were particularly desirous of being given some assurance that such a joint scheme as had been mentioned would be put forward next March. They could not go on the supposition that the parties to the conference would agree and then find in March, having refused consent to this station at Barking, that no comprehensive scheme was forthcoming. Sir A. Kennedy expressed the view that there was room in the existing stations for plant to carry on until 1925, by which time a new large power station would undoubtedly be required for London. He believed he was almost the only engineer who had not sworn by Barking, and although he had not turned Barking down, counsel might take it that the conference would submit to the Commissioners in March a proposal for another site which he and his colleagues regarded as distinctly preferable. This site was west of Barking, and would be sufficient to accommodate 400,000 kw. eventually. Negotiations were actually in progress with regard to acquiring the site. He was not sure that it would be wise to start building a capital station to-morrow, if it were possible, because the extensions which the Commissioners had, by *force majeure*, been compelled to sanction in the existing stations, would carry the undertakings along for several years.

Mr. George Hume, chairman of the Electricity Committee of the London County Council, said that the companies and local authorities were working in the greatest harmony, and had left the preparation of the technical part of the scheme to the committee of engineers already referred to. The financial and administrative aspects of the scheme were now being worked out. In the unfortunate event that the parties could not agree on a scheme, it was the determination of the London County Council to bring a complete scheme forward on its own account, because the Council considered it was its duty to do so in view of the terms of the Electricity (Supply) Act, 1919. The Commissioners ought not to contemplate the position that no scheme would be presented to them in March next year.

Mr. Duncan Watson, chairman of the Conference of Local Authorities and Companies which was preparing the scheme, said the utmost harmony prevailed, and there was a real hope that a comprehensive scheme would be submitted next year. He did not anticipate any substantial difficulty in financing such a scheme. There was, he knew, a difficulty in raising money for housing schemes, but that was due to a feeling that the money was wanted for one class only, whereas electricity benefited all classes. The Conference would certainly welcome the co-operation of the County Co.

On Saturday, October 9th, Mr. H. Lloyd, K.C., summing up on behalf of the County Co., said that counsel for the opposition had spoken as if the County Co. was desirous of stereotyping the parochial system and of keeping in its own hands a portion of the supply of London, whatever became of the other, and at the next moment he had spoken of their desiring to usurp the functions of a much larger body which might be hereafter formed. How those two views were reconcilable he found it difficult to see. The company had had to refuse business in the past, and their present position was impossible. Their engineers had shown that the site could be used for a much larger scheme, but that was a matter for the future, and a matter which some other body probably to be formed would undertake, but not themselves, and he maintained that they were not pre-judging or hampering any larger scheme. They hoped it would not be long before many railways would be driven by electricity, and the one thing most conducive to that change was a proper supply of electricity. When a railway was contemplating such a change it was common sense to say that if they could find energy available from a reliable source at a reasonable cost they would rather have it than spend the capital to put up their own station. It was no good waiting for the railways to come along and ask them if they would supply them. That was not business. It was said that the station would not be sufficient, but if the company had the station on the lines proposed it could be extended in much less time and at less cost than providing a new station. Had it not been for the war the station would have been running. Although counsel for the opposition represented so many authorities and companies in London, not one of them had come forward and said that it was able or willing to give the County Co. a bulk supply. Were they to be content to say that the future would provide for itself and that everything would come right, or were they going to make some attempt to deal with the great shortage? If a board was going to be formed in a night, if it was going to formulate a scheme next morning and everything was to be constructed immediately, it might be that the difficulties would be got over. The present position was that the three interests represented by the London County Council, the local authorities, and the supply companies had formed committees and appointed engineers to consider the matter from a technical point of view. One of their witnesses had said that they had agreed to turn down the Barking site, two others had said that they had not made up their minds and that they wanted the next few months to consider it, and the one that had said they had agreed to turn it down had also said they had not. That was the first element of agreement which was to result in the scheme. Where were they? Supposing that they had not turned it down, and that they wanted it for a site for the supply of the whole of London. They could have it; there was nothing to prevent it. It was left to the Commissioners to provide the requisite protection. If it was assumed that they had turned it down, what was the good of going to the Commissioners and saying that the County Co. was prejudicing their scheme until they knew what generating station was to be proposed? He was content that the Commissioners should protect the opposition in their own way, provided they did not prevent his company from raising money. The company had agreed to sell to the larger undertaking, and the consent of the Commissioners could be granted upon that assumption. Supposing hereafter the company would not sell? In such circumstances he ventured to think that a Government Bill would be passed in a very short space of time providing for compulsory purchase. If consent were given, the company could not proceed with the raising of capital until after the 1918 Act had been amended to provide for a higher rate of interest payable out of capital during construction.

The inquiry then concluded.

Electrolytic Copper Production in Sweden.— During the course of the war some of the large consumers of electrolytic copper in Sweden, with the support of financial institutions and other interests, reached the conclusion that it would be advisable to endeavour to render the country independent of foreign supplies, particularly as deposits of copper ore already existed in the country, and the Government also decided to assist a scheme of this kind. It was, however, not until the year 1918 that the A.B. Elektrolyt Verken, of Västeras, was formed by some twelve companies. It appears that in addition to the share capital provided by these companies and by other parties, the Government took up a nominal amount of 1,000,000 kr. in shares, but it has so far been impossible to place the undertaking on a sound financial basis, owing to inadequate funds. The works at Västeras was brought to a standstill last year in consequence of a strike, and operations have not yet been resumed, although loans have been raised at the company's bankers, and are now due for repayment unless the shareholders give personal guarantees in proportion to their respective shareholdings. On its part the Government has declined to give a guarantee, but the other shareholders are prepared to do so provided that the Government will agree to a modification of the company's contract with the State hydro-electric department with regard to the supply of electrical energy. An application has been made to the Government to this effect. If the suggested alterations of what is termed a burdensome contract are conceded, the private shareholders will accept the responsibility in question; otherwise they declare their inability to incur further economic risks on behalf of the company, the maintenance of which is said to be necessary not only in the interest of the industry, but also in that of the Government.

IMPROVEMENTS IN STREET LIGHTING.

Recent improvements effected in the lighting of part of the City of Westminster area supplied by the Charing Cross, West End & City Electricity Supply Co., Ltd., demonstrate the striking advantages which can be gained by the use of gas-filled incandescent lamps in conjunction with scientifically designed fittings. A short *résumé* of the systems which were tried before deciding on the gas-filled lamp will make the reason for its adoption obvious.

About 20 years ago the Charing Cross Supply Co. put in the first installation of open type arc lamps, which were replaced later by flame arcs. During the war, when lighting restrictions came into force, various expedients were tried to reduce the candle power of the lamps. These proved unsatisfactory, and finally, a few weeks before the armistice, the flame arcs were taken out and 100-watt gas-filled lamps fitted in the arc lamp cases.

When the time came to restore the lighting to pre-war standards the Supply Co. decided, after careful consideration, to abolish arcs altogether in favour of the fittings and lamps described later. The chief reasons for coming to this decision were the low maintenance costs of gas-filled lamps compared with arcs, and the improved control of light which could be obtained.

Fig. 1.—Standard with two "Metropolitan" Lanterns.

The area in which the new system has been installed includes the Strand, St. Martin's Lane, Northumberland Avenue, Trafalgar Square, Leicester Square, The Haymarket, Long Acre, and part of Charing Cross Road and Whitehall. In all 122 standards have been converted.

Fig. 1 shows the general design and proportions of the posts. The lanterns are of a special pattern, each one containing a 200-volt, 750-watt Osram gas-filled lamp. The total wattage per post is, therefore, 1,500.

Fig. 2 shows an illumination curve plotted from readings taken on lamps in Northumberland Avenue. The posts were 160 feet apart, the distance from the lamp filament to the ground being 25 feet. The maximum illumination recorded, directly under the lamps, is 2.6 foot-candles, the minimum is 0.3 foot-candles, midway between the standards. These figures show the even distribution of light, the diversity factor, or ratio of maximum to minimum illumination being as low as 8.6.

Fig 3 is reproduced from an untouched photograph taken by artificial light, and gives some idea of the excellent effect obtained.

Having described the improvement which has been effected it is interesting to note how these results were obtained. The fittings, supplied by the General Electric Co., Ltd., embody the latest improvements in design, and possess several new features.

The lantern, which is known under the name of the "Metropolitan," is shown in fig. 4. The constructional details are shown in the sectional view, fig. 5.

A system of ventilation (patent No. 137,914) has been introduced in the lantern, which, while providing a large radiating

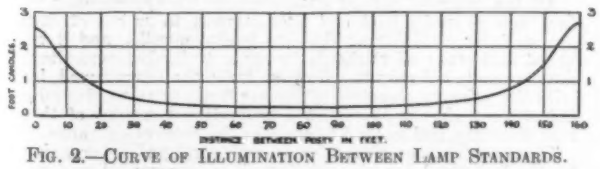

Fig. 2.—Curve of Illumination Between Lamp Standards.

surface, allows of a current of air being drawn continuously over the lamp. A sectional plan of the ventilating device is given in fig. 6, the arrows showing the course of the air currents. Thermometer tests show that with this system of ventilation the temperature rise is 25 per cent. to 30 per cent. less than is the case with the old type of ventilators. In this connection it is interesting to note that recent tests on gas-filled lamps have shown that their useful life depends to a great extent on the temperature of the air surrounding the bulb.

The reflector is formed of a substantial casting which gives the lantern sufficient weight to reduce the tendency to swing in high winds. The reflecting surface is finished in white vitreous enamel, which is easily cleaned and is permanent. The "Metropolitan" lanterns are fitted with Holophane refractor globes. These are fixed in a hinged ring, and by loosening a single fly nut, access is obtained to the inside of the lantern for replacements and cleaning purposes. A special

Fig. 3.—Night View in Pall Mall East.

U-section rubber gasket forms a water-tight joint between the rim of the glass and the lantern, and guards the rim against breakage.

In any lantern designed on definite optical principles the problem of providing an efficient, and at the same time easily manipulated focusing device merits special attention. Improvements in the manufacture of the lamps themselves are often accompanied by changes in dimensions, and if some means for compensating for this were not embodied in the lantern the light distribution would be adversely affected.

Fig. 4.—G.E.C. "Metropolitan" Lantern.

The correct focal position can be quickly and easily fixed by means of the ratchet focusing device (patent No. 143,048), shown in fig. 7. To focus the lamp it is only necessary after screwing it into the holder to push it gently into the correct position, where it is immediately held by the ratchet. As focusing has to be done in all weathers and generally at the top of a ladder, this is a most important feature. To facilitate further the operation special templates were made so that by fitting them over the lamp when it is in the reflector the attendant can see at once when the lamp is correctly set.

The installation was designed by the illuminating engineering department of the General Electric Co., Ltd., to the specification of Mr. W. B. Thorpe, chief engineer of the Charing Cross, West End & City Electricity Supply Co., Ltd., to whom we are indebted for permission to publish this description.

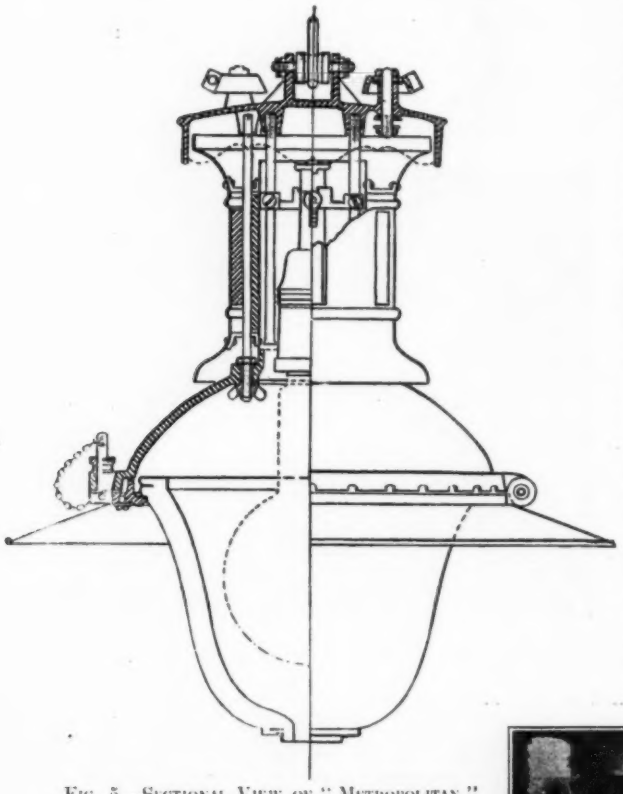

Fig. 5.—Sectional View of "Metropolitan" Lantern.

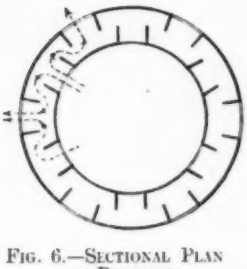

Fig. 6.—Sectional Plan of Patented Ventilating Device.

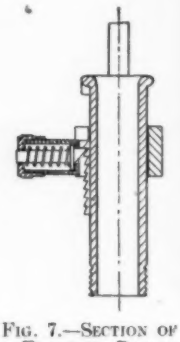

Fig. 7.—Section of Focusing Device.

THE NECESSITY OF STABILITY IN INDUSTRY.

A Conference was held last week-end, under the auspices of the Industrial League and Council, at the residence of Mr. Hugo Hirst, "Fox Hill," near Reading, to discuss the serious situation which is developing throughout the country owing to the instability that obtains in industrial affairs. In addition to Mr. Hirst, the head of the General Electric Co., Ltd., the following gentlemen were among those who took part in the conference:—The Rt. Hon. G. H. Roberts, M.P.; the Rt. Hon. R. McKenna; Major-General Sir Newton Moore, M.P.; Mr. E. W. Petter (Messrs. Vickers-Petters, Ltd.); Mr. David Gilmour (Scottish Miners); Mr. E. Manville, M.P.; Mr. John Baker (Iron and Steel Trades Confederation); Mr. J. D. Boving (Messrs. Boving & Co., Ltd., hydraulic engineers); Mr. Clatworthy (Cardiff); Mr. G. Dallas (Workers' Union); Mr. M. Railing, Dr. A. Railing and Mr. J. Y. Fletcher (General Electric Co., Ltd.); Mr. F. Rosling (Messrs. W. T. Henley's Telegraph Works Co., Ltd.); Mr. Frank Smith (Shipbuilding Trades Federation); Mr. C. Wilson (the Osram-G.E.C. Lamp Works); Mr. Jabez Hall (Iron and Steel Trades Confederation); Mr. Pretty (Messrs. Huntley & Palmer, Ltd.); and Mr. John Ames (General Secretary of the I.L. & C.).

The discussion was opened by Mr. E. W. Petter, who, dealing with the position of affairs from the employers' point of view, showed how disastrous had been the effect of the unrest that had been disturbing industry for the past two years. Employers, not knowing from one day to the next what new demands would be made upon them, were unable to quote firm prices to contracts or even a definite date for delivery, and the result had been that contracts, worth in the aggregate millions of pounds, had been taken from England and placed abroad. He cited instances of contracts which had been lost to this country through the causes mentioned, the result being reflected more and more by the conditions of the labour market. Large employers who had ventured to quote fixed prices in contracts found, when the contracts had been completed, that they had lost thousands of pounds on the transactions. They could not afford to go on doing that. Now, as the contracts in hand were being completed, manufacturers found they had not sufficient work to keep the whole of their plant in operation, and naturally they were dismissing men in all directions. Instability and loss of contracts were culminating in unemployment, and the time had arrived when workers and employers should look the whole situation frankly in the face and see whether they could not find a solution. If they could only agree to stability for a fixed period, approximately twelve months, during which time all should join in carrying on under existing standards, he had no hesitation in saying the outcome would be that the wave of unemployment would be stayed, industry would speedily recover and absorb the whole of the unemployed in the land, the cost of living would be automatically and materially decreased, and at the end of the year the workers, provided they stuck conscientiously to their work, would find they would not only be able to maintain their present rate of pay, but its relative value would be considerably enhanced, as the value of the £ would be brought considerably nearer to an economic level.

There was a decided unanimity of opinion as to the absolute need for stability, and the only variance of opinion expressed was with regard to the best means which could be adopted to attain that end. That the industries of the country should have an opportunity to compete on sound stable terms for contracts against foreign competitors, was regarded as essential to the welfare of the workers and the nation as a whole, but it was also emphasised and generally agreed that workers should be given a larger share in the management of the industry in which they were engaged, and a proportionate participation in any increased profits derived as a result of the united efforts made.

All the delegates viewed with considerable apprehension the fact that so much land had been allowed to go out of cultivation in England during the past twelve months, and it was urged that every effort should be made to further agricultural development, not only to afford work for the unemployed, but with the primary object of producing food, so as to give other industries a chance to export a proportional surplus of their manufactures, and so tend to equalise the rates of exchange.

These conferences of employers and employed as organised by the Industrial League and Council were regarded as a useful feature, and the delegates urged the necessity of such conferences being extended to every part of the country.

British Magnetos.—The judges' awards in connection with the Air Ministry Amphibian aeroplane tests show that the first prize-winner, Vickers "Viking III" with Napier "Lion" engine, and the third prize-winner "Fairey Amphibian" with Napier "Lion" engine, were fitted with B.T.H. magnetos.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Lamp with two Filaments.

A recent note in the *Electrical World* describes the construction of an electric light bulb with two filaments, manufactured by the Whitelite Electric Co., of New York. The "Dualite" (as it is called) has a cap screwed over the top of the part inserted in the holder. When the first filament burns out this cap is taken off and the lamp replaced in its socket, and the second filament is thus put into circuit. It is claimed that the gas with which the bulb is filled effectively prevents discoloration when the first filament gives out.

A Monorail Electric Hoist.

Included in one of the latest lists, illustrating various types of "Witton-Kramer" hoists, issued by the General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4, is the monorail electric hoist shown in fig. 1. The hoist is of standard Witton-Kramer design arranged for power lifting and travelling, capable of dealing with loads up to 20 cwt. at a speed of approxi-

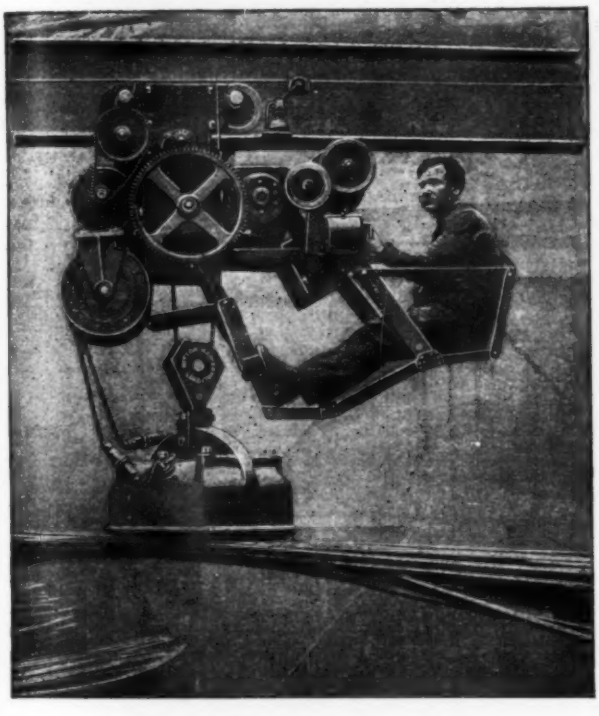

Fig. 1.—Witton-Kramer Electric Hoist.

mately 20 ft. per minute; the output of the motor being 2 h.p. at 750 r.p.m. A suitable seat is provided for the operator who travels with the hoist. The magnet is the 39-in. rectangular type, and is used for dealing with steel angles, and it is claimed that it is possible to do work with this hoist and magnet in five minutes which previously took three men 45 minutes.

A Fire with Removable Elements.

Fig. 2 shows the manner in which the elements of the "Magnet" Model "A" electric fire, manufactured by the

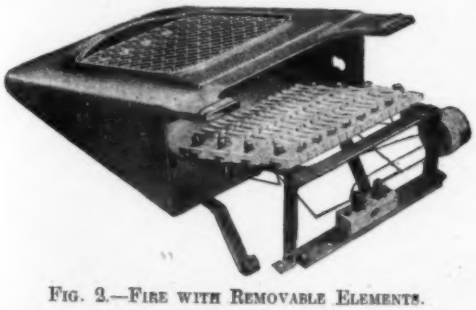

Fig. 2.—Fire with Removable Elements.

General Electric Co., Ltd., 67, Queen Victoria Street, E.C.4, may be removed bodily from their housing. In this way the renewal of elements becomes an easy matter, and new coils, earthenware segments, or complete elements may be put into position very quickly.

A New Bonding Nipple.

Our attention has been drawn to a new method of bonding small cables and wires for use with standard cast-iron joint boxes. This consists of a small nipple made of soft metal and screwed with ¾-in. conduit thread (fig. 3). Through the

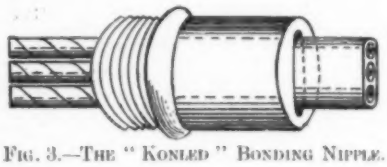

Fig. 3.—The "Konled" Bonding Nipple.

centre of the nipple is a slot through which the cable or wires are taken. The nipple is then screwed into the joint box, and bonding is effected by squeezing the soft metal over the lead sheathing of the cable (fig. 4). The chief ad-

Fig. 4.—Method of Closing the Nipple.

vantages of this bonding method are the absence of small screws and fixtures and facilitation of inspection. The manufacturers of this device, which is called the "Konled," are Messrs. Faulkner & Co., 5, Market Street, Manchester.

A Conduit Joint and Earthing Clips.

Messrs. Willis & Shaw, 37, Haley Hill, Halifax, have drawn our attention to a new conduit coupling recently patented by them. The coupling (fig. 5) consists of a split collar of spring steel, the ends of which are turned over to

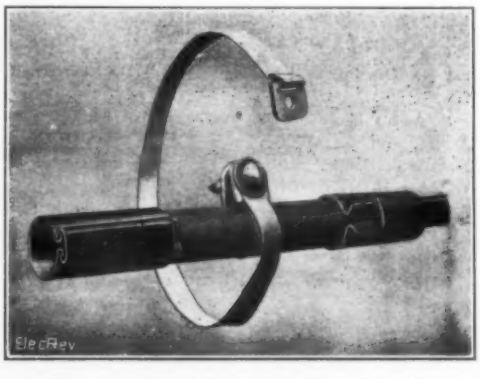

Fig. 5.—Conduit Joint and Earthing Clip.

provide a dovetailed ridge over which a tapered slide is forced. The inventors claim that for mechanical strength and continuity the device is equal to any conduit joint in present use. The earthing device will take any number of conduits or cables and with the same lug connects up without a break to the earthing screw on the switch.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

28,055. "Means of electrically heating contents of utensils." E. A. Welch. October 4th.
28,065. "Electric switches and circuit regulating devices." J. Bradley. October 4th.
28,069. "Electrical indicator." H. L. Holley and A. F. Norris. October 4th.
28,077. "Manufacture of frames for polyphase electric machinery." C. Ramoneda. October 4th. (France, February 10th.)
28,081. "Apparatus for separating or sorting by electric conductivity." H. L. A. Schweitzer. October 4th. (France, October 3rd, 1919.)
28,085. "Electrical speed regulator systems." Metropolitan-Vickers Electrical Co. October 4th. (United States, October 2nd, 1919.)
28,090. "Electric inductance apparatus." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. October 4th.
28,091/2. "X-ray apparatus and methods." W. D. Coolidge. October 4th. (United States, July 9th.)
28,094. "Electric insulators and their manufacture." H. Herrmann. October 4th. (France, June 4th.)
28,101. "Thermionic or vacuum tubes, &c." A. G. T. Cusins and J. H. Whittaker-Swinton. October 4th.
28,110. "Electro-magnetic switching apparatus." R. E. H. Carpenter and F. G. Creed, and Creed & Co. October 4th.
28,116. "Electroscopic apparatus." F. A. Johnsen and K. Rahbek. October 4th. (Denmark, February 15th, 1919.)
28,143. "Telephone systems." Automatic Telephone Manufacturing Co., C. Gillings, and R. Mercer. October 5th.
28,167. "Sparking plugs." C. O. Mecke. October 5th.
28,181. "Shock absorber for power transmission systems." A. Alltree. October 5th.
28,198. "X-ray apparatus." British Thomson-Houston Co. October 5th. (United States, October 29th, 1913.)
28,199. "Operating mechanisms for searchlights." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. October 5th.
28,203. "Electric lamp, &c., brackets." V. C. Bond and F. Marpole. October 5th.
28,207. "Electric heating device for plunging." F. Frei. October 5th.
28,208. "Deferred action dry battery." E. C. R. Marks (National Carbon Co.) and National Carbon Co. October 5th.
28,212. "Electric air diffuser." H. Ashdown. October 5th.
28,213. "Electric resistance switches." J. Watkinson. October 5th.
28,214. "Electric switches." J. Watkinson. October 5th.
28,249. "Sparking plugs." F. W. Schroeder. October 5th.
28,250. "Electric accumulators." Soc. de l'Accumulateur Tudor. October 5th. (Belgium, November 5th, 1919.)
28,252. "Incandescent electric lamps." W. E. John. October 6th.
28,264. "Speed regulation of electric motors." M. S. Conner and C. C. Puckette. October 6th.
28,270. "Sparking plugs." J. E. Burrows. October 6th.
28,278. "Electric switches." J. A. Crabtree. October 6th.
28,317. "Electrical apparatus for filtering, disinfecting, diffusing, and heating air, &c." W. E. Siday. October 6th.
28,318. "Production of high-tension electric currents." J. H. Swinton-Whittaker. October 6th.
28,327. "Electric induction apparatus." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. October 6th.
28,328. "Current interrupter for electric irons." A. Neachell. October 6th.
28,330. "Automatic control of electric motors." C. E. W. Talbot. October 6th.
28,338. "Automatic telephone pay station." G. A. Long. October 6th.
28,342. "Electrical oil switches." D. R. Davies and Metropolitan-Vickers Electrical Co. October 6th.
28,357. "Electrically illuminated traffic signalling devices." A. I. Marks. October 6th.
28,385. "Electric cable terminals." E. L. Bishop. October 7th.
28,386/7/8. "Electric switches." G. H. Ide and F. Painter. October 7th.
28,393. "Dynamometers." W. Sumner. October 7th.
28,395. "Electric heating devices." F. Maag. October 7th. (Switzerland, October 8th, 1919.)
28,400. "Valves for gas, electric, steam, &c., heating." G. Wilkinson. October 7th.
28,406. "Trolley heads for electric trams." G. L. Butler and M. J. Railing. October 7th.
28,430. "Electric welding apparatus." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. October 7th.
28,452. "Means for receiving wireless signals." Ges. für Drahtlose Telegraphie. October 7th. (Germany, October 8th, 1919.)
28,461. "Electric switchgear of the truck, &c., type." Johnson & Phillips and P. M. Wood. October 7th.
28,469. "Telephones, phonographs, &c." A. S. Bowley. October 7th.
28,479. "Sparking plug." R. S. Brown. October 7th.
28,489. "Sparking plugs." G. McIntosh. October 8th.
28,495. "Electric lamps." W. H. Walton. October 8th.
28,504. "Device for testing sparking plugs." G. H. Baxter. October 8th.
28,514. "Electric junction box." R. Crust. October 8th.
28,517. "Electrically operated warning signals." D. McGregor. October 8th.
28,520. "Magnetic separators." A. E. Davies. October 8th.
28,525. "Porcelain insulator." W. Powell. October 8th.
28,528. "Electric apparatus for recording and reproducing sound." A. F. Sykes. October 8th.
28,547. "Magneto-electric machines." F. I. Bennett. October 8th.
28,559. "Electric heating and ventilating apparatus." J. P. Ogle and Ventitheta, Ltd. October 8th.
28,577. "Insulators for suspension of high potential electric lines." A. Richard. October 8th.
28,579. "Sparking plugs." D. Pelabon and Pelabon, Ltd. October 8th.
28,585. "Hand tools for electricians, &c." S. E. Aaron and A. P. Smith. October 8th.
28,599. "Circuit controlling apparatus for wireless telegraphy." F. G. Creed and Creed & Co. October 8th.
28,603. "Apparatus for indicating opening or closing of electrical contacts, &c." J. Simpson. October 9th.
28,605. "Electric warning signal for left-hand-driven cars." E. A. Canniford. October 9th.
28,610. "Magnetos." R. Bosch Akt.-Ges. October 9th. (Germany, October 24th, 1919.)
28,612. "Sparking plug tester." W. H. Carpenter and A. W. Gillam. October 9th.
28,616. "Slow motion device for electric motor starters, &c." D. C. Sharp. October 9th.
28,650. "Automatic switches for electric heating apparatus." A. Kirk. October 9th.
28,665. "Electric oil switches." G. E. Gittins and Metropolitan-Vickers Electrical Co. October 9th.
28,681. "Electrical contact makers for steering wheels of motor vehicles." J. L. Scott. October 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,358. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co.). October 27th, 1916. (151,021.)

1917.

17,986. "Electric insulators." British Thomson-Houston Co. (General Electric Co.). December 5th, 1917. (151,022.)

1918.

7,308. "Machine switching telephone exchange systems." Western Electric Co. and L. Polinkowsky. May 1st, 1918. (Addition to 24,931/19.) (151,023.)

1919.

6,626. "Adjustable resistances." Evershed & Vignoles and S. Evershed. March 17th, 1919. (151,033.)
9,074. "Electrically propelled vehicles." J. Scott. April 10th, 1919. (151,035.)
11,694. "Electric accumulators." E. Lemaire. May 9th, 1919. (151,044.)
11,888. "Electric battery cells." A. Spencer. November 12th, 1919. (151,045.)
12,727. "Electrical devices for transmitting definite signals and for receiving said signals at a distance." J. W. Robinson. May 20th, 1919. (151,050.)
14,385. "Electrical step-by-step mechanisms, as used for propelling the hands of electrical impulse clocks." I. H. Parsons and A. E. J. Ball. June 6th, 1919. (151,057.)
14,758. "Oscillating apparatus for submarine signalling and other purposes." Submarine Signal Co. and G. C. Evans. June 11th, 1919. (151,061.)
14,825. "Aerial systems for wireless telegraphy." C. T. Wilkinson. June 12th, 1919. (Cognate Application 5,774/20.) (151,063.)
16,079. "Sparking plugs." W. J. Geddes. December 29th, 1919. (151,110.)
16,201. "Operating and tripping mechanism of oil break electrical switches." R. T. Norton. June 27th, 1919. (151,112.)
16,478. "Wireless transmitting and receiving apparatus for use on aircraft." L. A. McDougall and J. M. Poyntz. July 2nd, 1919. (151,115.)
16,638. "Means for varying resistance inductance or like coils." G. de P. Foglietta. July 3rd, 1919. (151,117.)
16,728. "Signalling systems with special reference to telephonic circuits." E. A. Graham, W. J. Rickets, and E. A. Sanftleben. July 4th, 1919. (151,118.)
17,337. "Magneto-electric machines." C. B. Redrup. July 10th, 1919. (151,125.)
18,989. "Variable electrical condensers." H. W. Sullivan and J. Joseph. July 31st, 1919. (151,138.)
19,251. "Telephonic transmission systems." Western Electric Co. (Western Electric Co.). August 5th, 1919. (151,140.)
20,669. "Electric ignition apparatus for internal combustion engines." E. A. Watson and M.-L. Magneto Syndicate. August 22nd, 1919. (Addition to 128,985.) (151,145.)
21,272. "Electric cable mountings for use on motor vehicles." R. W. Maudslay and Standard Motor Co. August 29th, 1919. (151,150.)
23,522. "Electrical propulsion of ships." Akt.-Ges. Brown, Boveri et Cie. October 1st, 1918. (133,301.)
24,074. "Devices for electrically heating hand-irons." D. Donaldson. October 2nd, 1919. (151,161.)
24,130. "Magnetos." American Bosch Magneto Corporation. October 26th, 1918. (134,823.)
24,224. "Magnetos." W. J. Mellersh Jackson (American Bosch Magneto Co.). October 3rd, 1919. (151,162.)
24,844. "Current distributors of electric ignition systems." F. A. Hood. October 10th, 1919. (151,166.)
24,931. "Machine switching telephone systems." Western Electric Co. (Western Electric Co.). February 25th, 1918. (Divided application on 3,333/18.) (151,167.)
28,501. "Electric gas lamps with glow discharge." J. Pintsch Akt.-Ges. December 12th, 1917. (Addition to 135,485.) (135,487.)
31,695. "Registering, recording, and receipt issuing apparatus for electricity, gas, and similar supply meters." C. A. Gustafsson. December 17th, 1919. (151,189.)

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2,814. "Short circuiting device for electrical ignition apparatus." O. Imray (Bosch Akt.-Ges., R.). January 29th, 1920. (151,199.)
3,073. "Electric switches." L. Trabet. September 16th, 1919. (151,200.)
3,939. "Ignition magnetos for internal combustion engines." Fabriques des Monrtes Zenith. April 15th, 1919. (141,672.)
5,233. "Electric circuit controllers." R. Amberton. February 20th, 1920. (151,206.)
9,023. "Use of thermionic devices in wireless and other signalling systems." Western Electric Co. September 3rd, 1915. (140,829.)
11,345. "Systems of supplying energy to electrical circuits." J. F. P. Jaubert. March 7th, 1919. (142,132.)
14,873. "Electric switches." Remy Electric Co. June 11th, 1919. (144,626.)
15,380. "Tubular electric condenser, and method of manufacturing same." G. Giles. June 16th, 1919. (145,008.)
18,019. "Suppressing the spark produced on breaking a circuit produced having self-induction." F. Krupp Akt.-Ges. October 23rd, 1915. (145,721.)
18,240. "Apparatus for regulating electric currents." F. Krupp Akt.-Ges. August 27th, 1917. (146,307.)

Service Notes.—Mr. W. H. Allan, acting second class draughtsman, Rosyth, has been transferred from the electrical engineer's department to the Admiralty. Warrant Telegraphist A. C. Greenhill has been appointed to the battleship *Erin*. Lieut. J. L. Winter, Edinburgh (Electric Lights Company) Fortress Engineers, has resigned his commission, and has been given the rank of captain. Lieut. W. F. Anderson, Lieut. D. H. Brown, Lieut. S. J. Fielding, Lieut. J. F. Galloway, Lieut. V. R. Kettle, Lieut. T. Lightbody, Lieut. W. G. Normand, Lieut. A. Russell, and Lieut. F. G. Witney, of the same corps, have resigned their commissions and retain their rank. Mr. F. C. Stacey, A Class supervisor, electrical engineer's department, Sheerness, has been transferred in a similar capacity to the Portsmouth Yard. Lieut. T. E. Taylor, Lancashire Fortress (Electric Lights Company) Engineers, has relinquished his commission owing to ill health contracted on active service.

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